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TOYS

AND

TALES

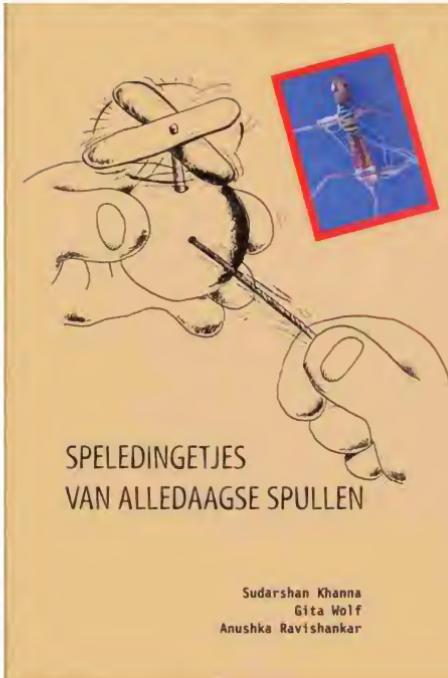
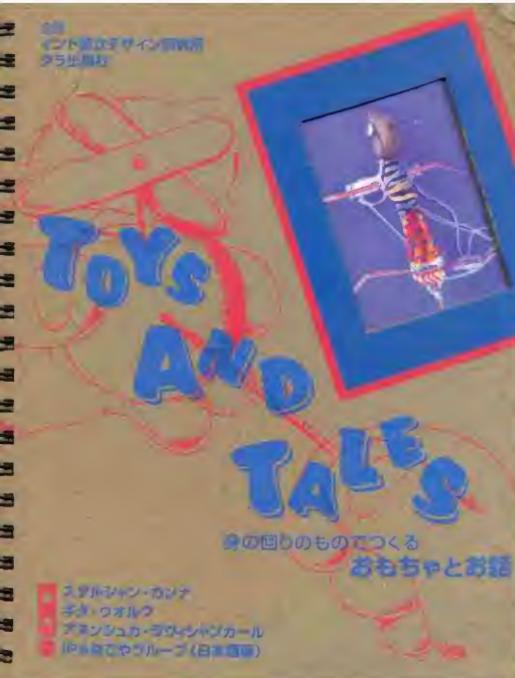
WITH EVERYDAY MATERIALS

Sudarshan Khanna

Gita Wolf

Anushka Ravishankar





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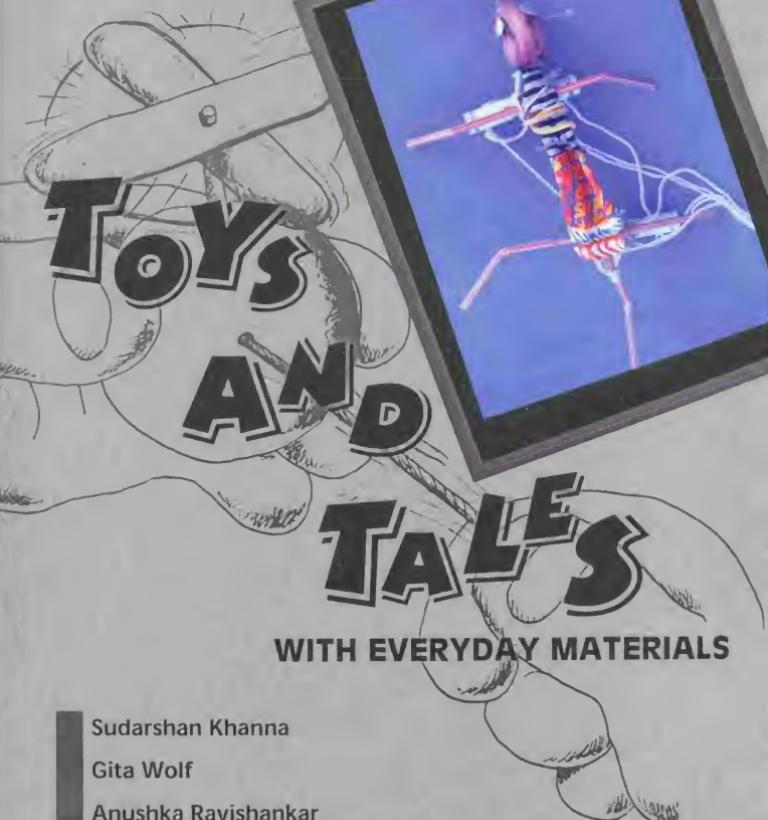
# TOYS AND TALES

WITH EVERYDAY MATERIALS

Sudarshan Khanna

Gita Wolf

Anushka Ravishankar



## Toys and Tales with Everyday Materials

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## How This Book Came About

*Toys and Tales* came out of a workshop on folk toymaking with children of different ages, organised by Tara Publishing and The School, KFI in July 1997. It was conducted by Prof. Sudarshan Khanna of the National Institute of Design, who has worked in this area for the past twenty-five years:

"When I looked around for examples of the creative and intelligent use of everyday materials, the perfect example seemed to be folk toys made by artisans and sold at fairs all over India. As a child I used to make ten to fifteen different types of toys, but these simple ideas are not known today. In 1972, at a fair in Ahmedabad, there were over a hundred action toymakers. Each year the number is decreasing. After several years of research, I developed and documented more than 150 toys. To create awareness about this vanishing craft, I conduct workshops with children, teachers and toymakers. At these workshops we recreate and redesign the toys I have collected over twenty years."

Anushka Ravishankar and I documented the process of the workshop for this book. Gradually, a concept for it began to emerge, based on our observations at the workshop. We noticed that children of different age groups, as well as adults who were part of the group, experienced toymaking in distinctly different ways. We have turned that experience into a multi-level book.

Gita Wolf

January 1999



## How to Use This Book

All the toys in this book were made by children. They are not like the ones you can buy in most shops. These toys are made of simple everyday materials, based on folk toys created by toymakers from different parts of India.

When we made the toys, different age groups reacted differently. The younger children were happy just making and playing with their toys. The older ones were much more curious to find out how they worked. And some of the adults wanted to know more about the toys and how children played.

So we designed this book to be used by different age groups. This does not mean that the divisions have to be followed strictly. You may belong to a particular age group and find yourself interested in other sections as well. If so, go ahead and dip into the book in any order you choose.

12

### If you are below 12

For each toy, these are the sections meant for you, which will tell you how to make the toy and play with it. The other sections are for older children and adults. Of course, if you find them interesting, feel free to read them.

This is how we have divided your section:

#### What it is made of

Under this heading, you will find a list of the materials you need to make the toy. If you cannot find the material we have used, try using something similar instead. For instance, if you do not have chart paper, you can use thin cardboard. Just make sure it has similar qualities, like thickness or the way it bends.

#### How it is made

Here, we explain how to make the toy, step by step. Each step is illustrated. The first time you do it, try to follow the instructions exactly. Later, you can try out variations. For example, you can turn a Break-dancer into a bird, or a Jitter-bug into a monkey.

#### What it does

This tells you how to make your toy work.

## When it doesn't

Sometimes a toy does not do what it is supposed to. Maybe there is nothing wrong with the way you made it, you may just need some practice to get it to work. Or you may need to pay special attention to a particular step in making it. Here we tell you where you might have gone wrong in making the toy.

## Games, Jokes, Stories and Tricks

After we made the toys, some of the children were content just to play with them. Others came up with all kinds of other ways of using the toys. We have included them in this section, to give you ideas on what you can invent.

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## If you are 13-16

Many of the principles that you have learnt in science can be seen actually at work in these toys. This section explains some complex scientific phenomena using the toys.

## A Scientific Principle

Here we explain the main principles on which the toy works. Sometimes, if there are too many different physical laws at work, we have only talked about the most significant of them, to avoid making it too complicated. You will find that some of the toys, but not all, have diagrams that show the forces that are acting on the toy. We have drawn diagrams only if they help in clearly illustrating the principle.

### Try

Here, we have suggested variations that you could try with the toy. Some of the variations give the toy a different look, others use the basic principle to make new toys. We have suggested experimenting with different dimensions, proportions and materials. Observe the changes in the way the toy works with these variations, and try to figure out why this happens.

### Think

Once you know how the toy works, it is interesting to connect these principles to phenomena we find around us. For instance, the Screech works just like our vocal chords do.

You might also be able to connect the way a toy works to what you are learning in class, either directly or indirectly. We have asked some questions to help you to think about these things.

Hint: here we do not give you the answers, but leave you with a clue.



## If you are an adult

The experience of making these toys with children led us to reflect on toys and play in today's world. This is something we rarely think about—after all, children have always played, with or without adult encouragement. Do we really need to spend time on something which comes so naturally to children? Shouldn't we, in fact, concentrate on getting them interested in more productive activities?

On the contrary. Play is essential for children, it is the business of life. It enables them to be creative in unstructured, imaginative and individual ways. Our observations also convinced us that parents and educators today need to be concerned about the ways in which their children play, and the toys they play with. Because the quality of play—which we have always considered as innate in children—has changed in our times, particularly in affluent urban areas. Although we are led to believe that children today have it far better than a generation ago, we need to find out if this is really so.

For one, many have too little time and space to play. Secondly, active play has been increasingly taken over by entertainment. And thirdly, a lot of play these days centres around expensive toys and games, with the media and the toy industry pressurising children into believing that they need all these commodities. We cannot expect young children to deal with these pressures on their own. They need adult guidance.

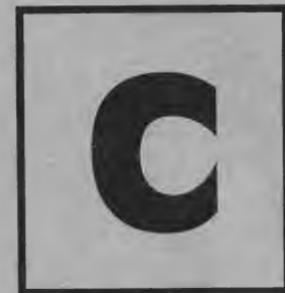
This section of the book is intended to enable the concerned adult to make such informed choices. It discusses a number of current issues related to toys and play, in the context of larger pedagogical and social concerns.

Our effort in this book is to bring back the now forgotten quality of play which arises from making and playing with folk toys, using everyday materials.

We do not suggest that this is the only answer to today's consumerist culture. That would be both romantic and impractical. As the section on the decline of traditional toymaking demonstrates, a genuine revitalising of this dying tradition is possible only with concerted action at many levels.

Yet we do believe that these wonderful toys are a potent symbol of the direction we need to take. They revive many qualities we do not value today: simplicity, ingenuity and a sheer delight in play which is not tied up with expensive products.

In the final analysis, we would like the reader to look at what is valuable and living in such traditions, and examine contemporary choices in that light.



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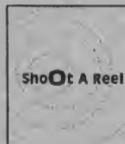
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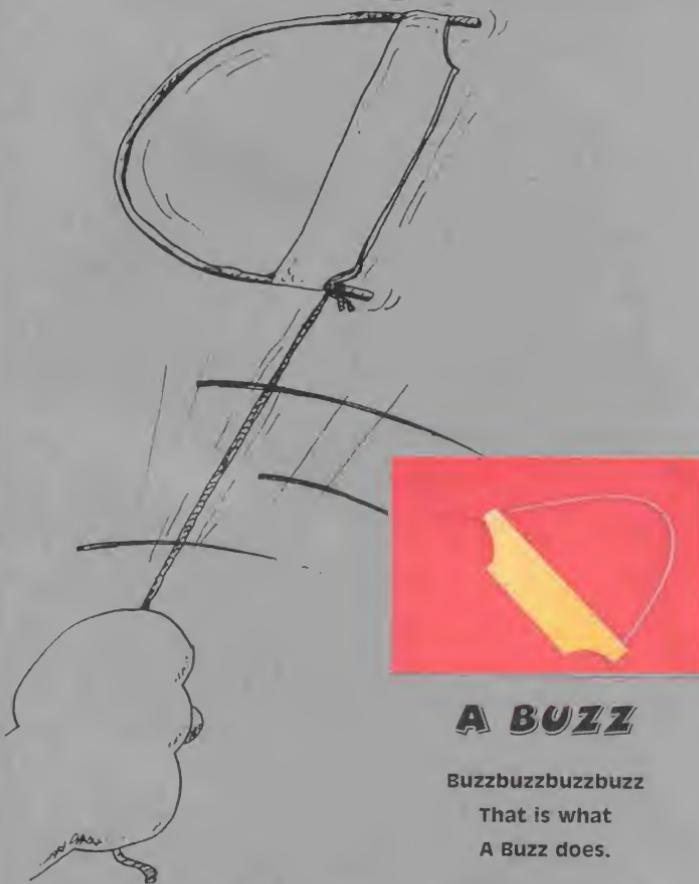
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Toys that Make Noise



## A BUZZ

Buzzbuzzbuzzbuzz  
That is what  
A Buzz does.

12

### A Buzz

#### What it is made of

- ◆ A chart paper strip, 25 x 2 cm
- ◆ A thin, flexible stick, 20 cm
- ◆ String, 40 to 50 cm

#### How it is made

1. Fold the chart paper strip in two and glue the open ends together.



2. Cut the two ends of the loop as shown.



3. Bend the stick and glue the two ends to the ends of the loop.



4. Tie the string to one end of the stick.



#### What it does

Hold the end of the string and swing it round swiftly. The Buzz will buzz.



## When it doesn't

Try swinging it faster. If it still doesn't buzz, check:

- if the stick is too flexible,
- if the flaps are jammed together.

## Buzz, Buzzer, Buzzest

Make all your friends stand in a row. Each of you swing your Buzz as fast as you can, and choose a winner. The winner can be chosen in different ways:

1. Whose Buzz is the loudest?
2. Whose Buzz has the highest (or lowest) pitch?
3. Whose expression is the most maniacal, as they swing the Buzz?
4. Who manages to swing it for the longest time without hitting anyone with it?

And so on.



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## Frequency of Sound

Sounds are vibrations of the air and can be generated by vibrating surfaces or membranes. The Buzz buzzes because the two flaps vibrate against each other. The bent stick keeps the two flaps in a state of tension. When it is rotated swiftly the tension in the stick causes the flaps to vibrate against each other. The number of vibrations per second is called the frequency of the sound. When the frequency is low, we hear a low buzz. If the frequency is increased the buzz becomes high-pitched.

### Try

Make a Buzz with different kinds of leaves and paper. Does each one sound different?

Use a shorter string and a longer string. Does the sound change? Why?

Hint: the sound is louder when air flows faster and in greater amounts between the paper flaps.

### Think

Why does the pitch get higher when you spin the Buzz faster and faster?

Hint: the number of vibrations per second depends on the speed of rotation.



## The Decline of Folk Toymaking

This toy was originally made with fresh palm leaves. Then toymakers began to substitute palm leaves with paper, to make a longer lasting toy. In spite of repeated evidence of such creative flexibility, there has been a steady decline in the number of folk toymakers in India. Where there were over a hundred of them at a typical fair around twenty-five years ago, there are now an impoverished four or five.

This tiny industry was widespread, offering an unbelievable variety of affordable and innovative toys. Individual artisans, families and craft communities used to travel around selling toys in villages and towns. They also 'mass produced' them for fairs and festivals. The same stalls now sell cheap plastic fare, dulling in their lack of variety.

Why are folk toys dying out? The reasons are complex, linked to the development of a culture and economy in which

1. Raw material used in traditional toys is becoming more scarce and expensive.

2. Local knowledge and craftsmanship is devalued. Mass produced goods claim to be standardised, modern and therefore superior. These goods are part of upwardly mobile middle class values and aspirations. From a class perspective, a folk toy is seen primarily as a poor child's plaything, meant for those who cannot afford anything 'better'.

So not only the middle class, but also the working classes prefer homogenised plastic toys, which spell upward mobility. A decline in local traditions is not recognised as cultural impoverishment.

3. A capital intensive toy industry is growing at a phenomenal rate. It not only floods the market with its wide distribution reach, but also creates a demand for industrially produced toys through extensive advertising.

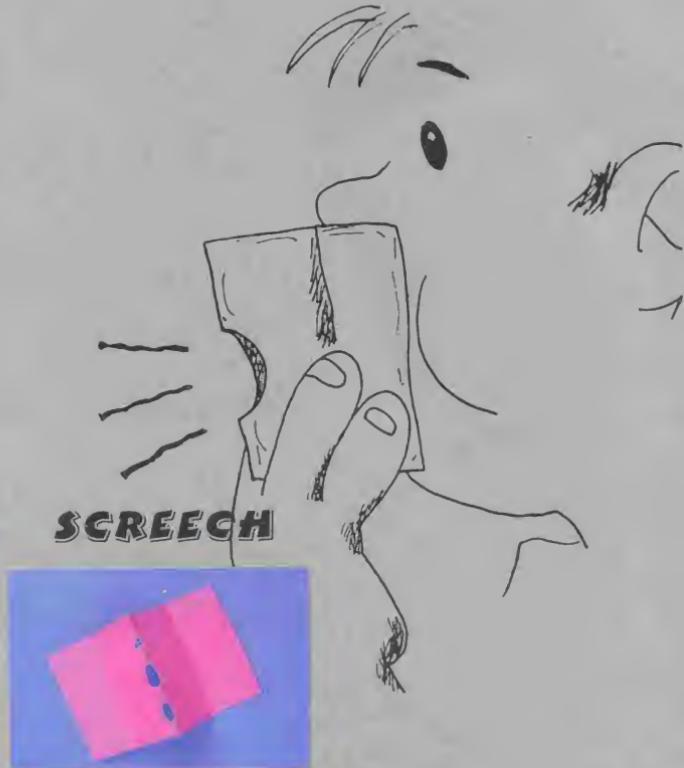
Folk toymakers have to contend with all this with no capital of their own. Being creative, flexible and innovative are no longer enough. Folk toys cannot co-exist peacefully with industrially produced toys, because capital and resources are so unequally distributed.

There are small efforts at reviving the dying craft, but unless it is looked at in a larger context of cultural and economic change, folk toys will remain ethnic and exotic. To bring them into the mainstream of children's play needs initiative at different levels. Only this will restore real choices in a rapidly homogenising world.



Selling toys 1990

Selling toys 1998



**IF you blow this long and hard  
A screech will be your just reward  
(By the way we do beseech  
Don't underestimate this Screech).**

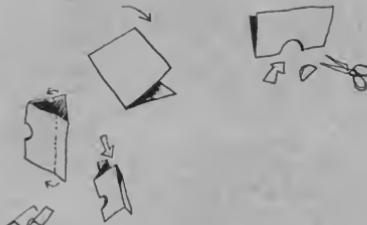
## Screech

### What it is made of

- ◆ A piece of paper, 5 x 10 cm

### How it is made

1. Fold the paper in half and cut out a hole in the centre.



2. Now fold out the two sides as shown.

### What it does

Hold the whistle between two fingers and blow hard. It might let out a shrill screech like a peacock with a sore throat. Or it might make a nasal noise like an elephant with a cold.

### When it doesn't

It usually works. If it doesn't, try holding it differently. Blow harder. If that doesn't help, blow gently. Keep trying. Suddenly, you'll be rewarded with a shriek.

### Sound Effects

Need a nice hair-raising scream in your murder-mystery play? Want a good shriek for the peacock in your puppet show? Use the Screech.

## Vibration of Membranes

What makes the Screech work? The noise is caused by the vibration of the paper. When you blow into it, the air passing through the hole causes the two sides of the paper to vibrate against each other, and a sound is produced.

### Try

What happens if you do not make a hole?

Try holding the two sides far apart and blow into the Screech. Does it screech?

Make more holes and see how the sound varies.

Change the size of the holes and listen to the difference in the sounds. Try a pin-hole and a huge hole.

Blow harder and observe how the sound changes. Does it screech louder? It should because when air flows faster and in greater amounts through it, the paper vibrates more.

### Think

Do you know where your voice comes from? When air flows between the vocal cords, a pair of tough membranes in the throat, the vocal cords vibrate, and sound is produced.

Now, compare your vocal cords to the Screech, and try to answer these questions:

How do you make your voice louder or softer?

Hint: why do you tend to take a deep breath when you shout?

How do you make your voice high-pitched and low-pitched?

Hint: when the cords are stretched tighter they vibrate faster.

When you are breathing normally, why is there no sound?



## Twenty-five Things

It was hard for us to imagine that anything as noisy and potentially disruptive as the Screech could have any merit, educational or otherwise. We decided to try something- ask the children what they experienced while making this toy. We did not expect them to come up with a list of twenty-five things.

1. Keep trying till you get things right.  
2. Don't waste even a small piece of paper. It can be used.

3. Every time you blow you get a different sound.

4. Some people buy these things made of plastic, we can make ourselves with paper.

5. Anybody can do it.

6. Waste paper can be used.

7. Can be done with leaves.

8. When we blow we feel sleepy

9. We can make anything, if we use imagination and we think a bit.

10. Works best in dry places.

11. Don't like the feeling when I blow

12. Vibration of the paper cause sound.

13. Noise is very low-pitched and irritating.

14. Thinner paper, more holes= lower pitch.  
Thicker paper, less holes= higher pitch.

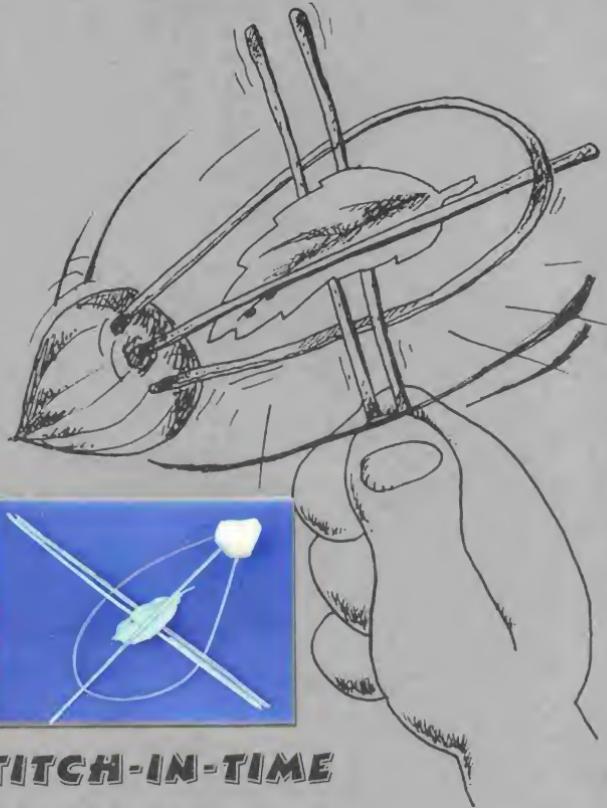
15. Three toys from one piece of paper.

16. Can make toys with materials not generally found.

17. Be patient until it works.
18. Works better with three holes.
19. Keep using the paper used until it wears out.
20. Can make sound with paper.
21. When you have nothing else to do or play with, you can make your own toy.
22. Learn to listen.
23. Learn science while making toys.
24. If a bought toy breaks, you can't make it again. If a toy you make breaks, you can make it again.
25. It can be given as a gift.



Did we leave out anything?



## STITCH-IN-TIME

Can you have a ghost without the dead?

Can you stitch a leaf without a thread?

A Stitch-in-time can do the latter

Though the leaf might end up a-tatter.

# 12

## Stitch-in-time

### What it is made of

- ◆ A baby coconut or a small potato or onion
- ◆ 4 thick broomsticks: one 30 cm, one 15 cm and two 20 cm

### How it is made

1. Sharpen the ends of the 30 cm stick and insert both ends into the onion, forming a loop.



2. Insert the 15 cm stick into the onion, so that it is at the centre of the loop.



3. Place the leaf over the central stick.



4. Push the two 20 cm sticks under the loop and over the leaf, as shown.



### What it does

Hold the two sticks and rotate the machine fast. It sounds exactly like a sewing machine. The leaf moves forward with every 'stitch', and finally falls off. Pick up the leaf and look at it. It has a stitch running down it!



Caution: make sure the stick and onion don't fly off.

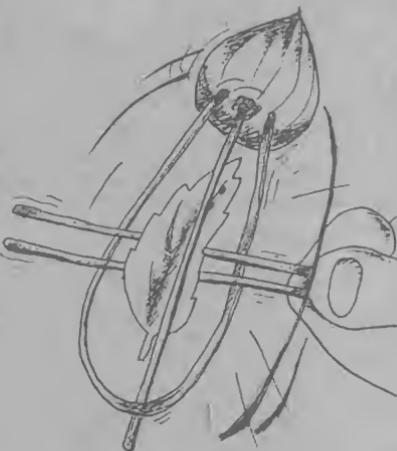
### When it doesn't

Make sure all the sticks are properly fixed. You must hold the sticks firmly together, but not too tightly. See if the onion is too heavy. If it is, chop a little off.

### Rhythm Band

Some of the children made a group, and tried to rotate their Stitch-in-times at different speeds. So each one got a different rhythm. To the rest of us it sounded like noise, but they insisted that it was music.

We did not ask for an encore.



## Transport Mechanism

The two sticks get twisted and turn around with every rotation. The one that is on top hits the leaf with a sharp tap as it switches places with the one that is below. The force of the tap makes a hole in the leaf. The stick also pushes the leaf forward, creating a transport mechanism which converts the rotation into a forward movement.

### Try

Would this work with cloth, or even paper? The leaf is soft and easily pierced. Cloth and paper would be able to withstand the force of the stick.

The cloth would muffle the noise, since the sound would get absorbed. The leaf, although it is soft, does not absorb the noise, because it gets cut at that point.

### Think

The transport mechanism at work in this toy is similar to the mechanism that operates in a conveyor belt. Can you think of other instances where rotation is converted to a forward movement?

## Short-lived Toys

This used to be a very common toy in Kerala, made with baby coconuts which had fallen from trees. It was unknown in other parts of the country, probably because baby coconuts are not freely available. Another reason for the local nature of the toy also occurred to us. We found that it worked only as long as the coconut was fresh. So by its very nature, the toy was short-lived. It could not be produced in large numbers, and couldn't travel very far.

We thought of the special quality of the experience that this toy offered the child. In our experience, children often play with a toy for a while and then tire of it. While this is a problem with expensive toys, the short-lived nature of toys such as the Stitch-in-time dealt with this naturally.

The children were intrigued by the noise and the stitches on the leaf, and they were free to investigate the workings of the toy by taking it apart. This freedom was possible because it was quickly put together and as swiftly dismantled. It did not matter if the children made mistakes or even broke the toy in the process. In fact, the nature of the toy invited this.



A papaya leaf trumpet lasts one noisy day



## CROAKERDILE

Never smile at a Croakerdile  
For he's a moody kind of bloke  
Keep a straight mug  
And mutter "Guggugg"  
Or he might refuse to croak.



12

### Croakerdile

#### What it is made of

- ◆ Clay
- ◆ String, 15 cm
- ◆ A thick stick, 15cm
- ◆ A used matchstick
- ◆ Thin strong paper, 8 x 8 cm

#### How it is made

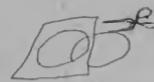
1. Make a small, shallow clay pot, about 4 cm in diameter. Let it dry completely.



2. Tie a small piece of the matchstick to one end of the string.



3. Cut out a piece of paper big enough to cover the pot.



4. With a pin, punch a small hole at the centre of the paper and pass the string through it, as shown.



5. Paste the paper over the open end of the pot, with the piece of stick inside and the free end of the string hanging out. The paper should be tightly stretched.



6. Cut a groove in the thick stick and tie the free end of the string loosely around it.



#### What it does

Put a few drops of water at the place where the string is attached to the stick. Meanwhile, mutter the magic words: Om Guggugg Shree Tinnavalli. Swing the drum, using the stick. Your Croakerdile will croak.



#### When it doesn't

Laryngitis? Lost its voice?

Or maybe Guggugg and Tinnavalli are displeased? While chanting, you have either put too little or too much water.

Have you stuck the paper onto the drum properly? Is the string tied so tight that it has no space to move? This will make it wind around the stick, instead of moving around it. Don't tie it too loosely either, or the drum will fly off the stick.

#### The French Connection

A few decades back there was a tradition in the French army. While coming back from battle after a victory, each soldier carried a Croakerdile, much bigger than this one. When they entered town, they all croaked loudly together.

#### Variations on the Croakerdile

- ◆ Frog
- ◆ Turtle
- ◆ Jester

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## Transmission and Amplification of Sound

The friction between the wet thread and the stick produces a slight sound. The sound travels along the string in the form of waves. This makes the paper surface vibrate and the sound is amplified because of the large surface stretched over the drum.

Why doesn't the Croakerdile croak if there is no water? The friction between the two surfaces is usually too slight to cause a croak, but a drop of water makes the string swell, and therefore increases the friction. If you put too much water, the water acts as a lubricant between the string and stick, so there is less friction.

#### Try

Change the length of the string. If the string is longer does the sound get louder or fainter?

Will changing the size of the drum affect the sound? How?

Use paper of varying thickness and see how the sound changes. If you use cloth in place of paper, do you think the Croakerdile will croak?

Hint: all materials absorb some sounds and transmit some. Soft materials are good at absorbing sound.

If you get carried away and use many layers of paper, the Croakerdile is silenced. Why?

#### Think

Traditionally this toy was made of hair from a horse's tail, and not string. Can you guess the reason for this?

Hint: If you use horse hair, you need not invoke Guggugg and gang.



## Things which Became Toys

When we found out that the Croakerdile was used by soldiers in the French army long ago, we started thinking about other toys which didn't start out as toys to begin with.

We began to read up on toy histories, and discovered that many of them had a long tradition, not necessarily associated with childhood. This fascinated the children.

In ancient times, in many parts of the world, small clay figurines, root carvings and small painted animals were part of ritual. Some of them later became toys.

We read of artifacts designed in later centuries, to provide amusement for royalty or the aristocracy. The earliest doll's houses, for instance, were Dutch cabinets filled with miniatures made in silver and other precious metals.

Musical toys and tin automata with clockwork movement were created by inventors as experiments in scientific principles, and as simulations of independent life.

Some of these mechanical toys seemed to have been really macabre. Like the sixteenth century life-sized tiger of Tippi Sultan, which ate up its feebly struggling victims, while simulating real groans.

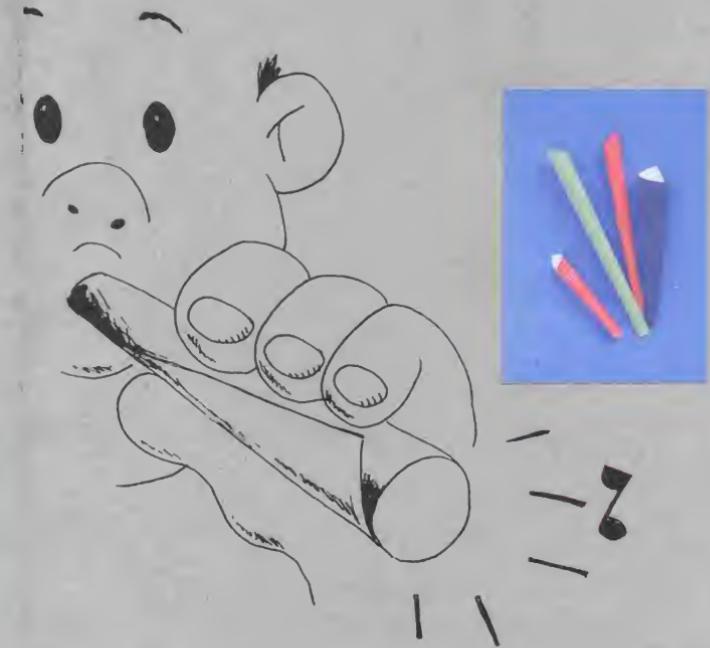
The classic among mechanical toys was the legendary nightingale which appears in the Hans Andersen story of the same name. We read out the story, in which a mechanical nightingale made of silver and gold, studded with sapphires and rubies, supplants a real nightingale in the Emperor's favour.

When it was wound, it sang like a real nightingale, its silver tail going up and down.

On their own, during the next few days, many of the children brought in histories of toys, from their parents and grandparents, and from books they had looked up. It added a whole new dimension to the way we thought about toys.



Work or play?



### **FLUTE-HOOT**

**This is a special flute  
It gives a hollow hoot  
When it's in the mood  
It sounds quite good  
And when it's not it's mute.**

## Flute-hoot

### What it is made of

- ◆ A piece of paper, 8 x 8 cm

### How it is made

1. Roll the paper into a tube, letting the layers overlap as shown.



2. Glue the loose end of the paper to keep the tube from opening out.

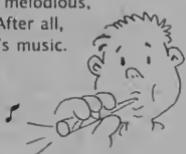


3. Flatten one end a little.



### What it does

Blow into the Flute-hoot from the flattened end. You should hear a melodious sound. More often than not, the sound you get will seem far from melodious, especially to other people. So what? After all, one person's noise is another person's music.



### When it doesn't

Try thinner, stiffer paper and see if it works. If it still doesn't, maybe you aren't blowing the right way. Push the flute a little deeper into your mouth and try again.

Is the flute moist with all that blowing? If it is, it won't hoot, but don't let a damp flute dampen your enthusiasm. Dry it, or make another and keep trying.

### Moody Toy?

We huffed and we puffed, but all our flutes remained stubbornly silent. It was most disappointing. What could be wrong?

One boy claimed that all that blowing made him sleepy. Had we discovered a cure for sleeplessness? Very unlikely.

The next day we brought different kinds of paper—slightly stiffer and thinner. We made the flute again. After much blowing and puffing, some of us finally got it. Others kept trying.

One child swore that her flute worked perfectly at home. "Then why won't it work now?" we scoffed disbelievingly. "It's not in a mood today," she replied.



## Vibration of a Reed

The flute hoots because when you blow into it, air flows through the narrow mouthpiece, and makes the paper vibrate. If the weather is humid, the paper absorbs moisture, and loses elasticity, so it does not vibrate.

### Try

Use a peepal or banana leaf to make the flute.

Make it with different kinds of paper. Do all of them work?

Try different lengths and note how the note changes.

Is it possible to get different notes from the same flute?

### Think

Why should the end of the flute be flattened, before blowing into it? Could it have something to do with the way the air enters the flute when you blow?

Many musical instruments use this principle of vibration that is caused when air escapes through a hole.

How is this flute different from a real one? This flute works on the principle of vibration. A real flute makes a sound because of the resonance of air in a column.

## Process and Product



Still trying ...

understanding of material properties—of the specifications of paper and its relationship to the quality of the sound produced.

It also enabled children to deal with failure in positive ways. When a hoot didn't make any sound, the child looked to her neighbour; why did his toy work?

She could re-examine hers, blow harder, stretch the paper differently, remake the toy entirely, or ask for help. Once it worked, she could compare the quality of sound with that of her neighbour's.

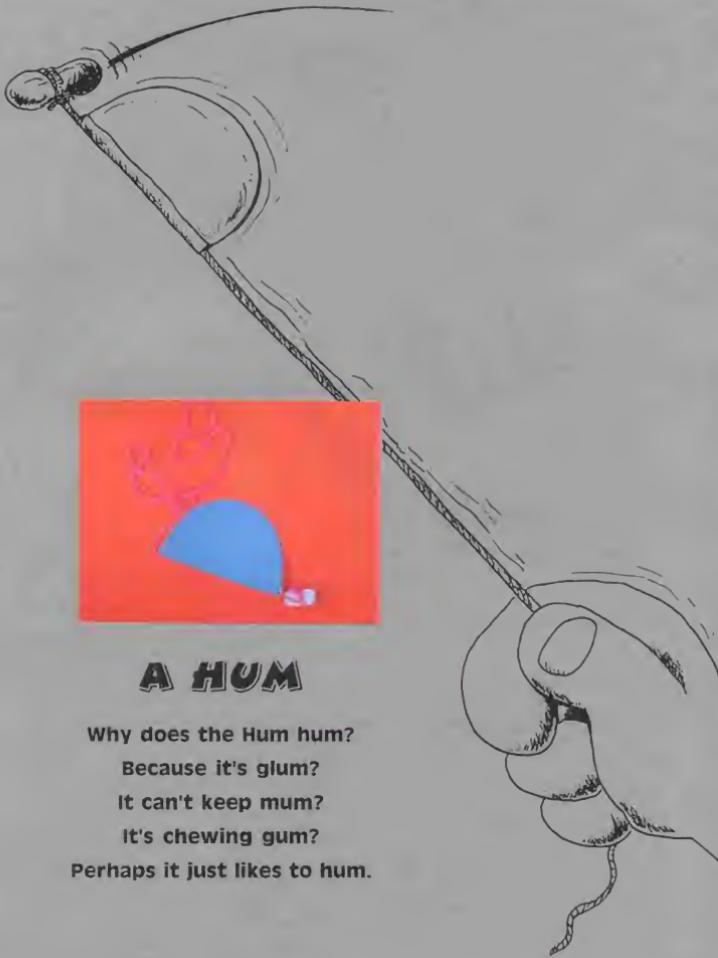
Setting right a toy which did not work also led to an important insight. When you create something, you take responsibility for it.

One child said, "If you buy a toy and it doesn't work, you would go and exchange it, or even throw it away. But if you have made it, you have to find out why it doesn't work and try to make it work. Or you have to make excuses for it—mood, weather, or bad paper."

The toy you make yourself is not just a product which does or does not work, but a process of which you are a part.

We expected children used to complicated high-tech toys to be unimpressed about making a noise with bits of paper. But we were wrong. The excitement was centred on how to get the toy to work. It seemed simple enough to create, but completely unpredictable in its response. We were surprised at the learning potential this little bit of paper afforded.

Making this toy required manual skills of rolling and folding paper precisely, learning how to hold it, and blowing air in particular ways. On a more abstract level, it led to an



## A HUM

Why does the Hum hum?

Because it's glum?

It can't keep mum?

It's chewing gum?

Perhaps it just likes to hum.

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### A Hum

#### What it is made of

- ◆ Foil or shiny wrapping paper, 12 x 6 cm
- ◆ String, 40 to 50 cm
- ◆ Eraser

#### How it is made

1. Tie the eraser to one end of the string.



2. Cut the paper into a semi-circle, about 10 cm in diameter.



3. Fold the edge and glue it over the string, close to the eraser.



#### What it does

Hold the end of the string, and swing the Hum around swiftly, to make it hum. Just be careful not to hit anybody on the head with the eraser.



## When it doesn't

### Check:

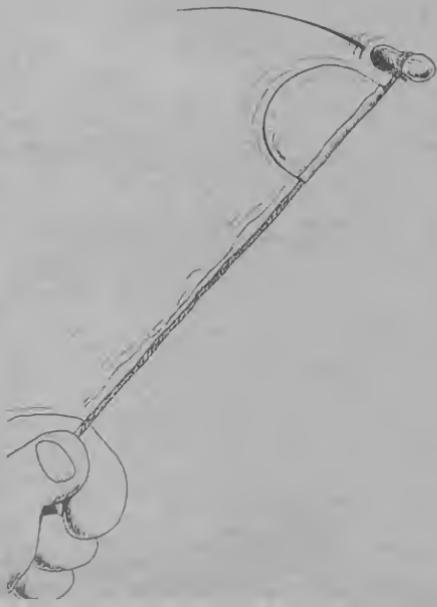
- if the paper is thin,
- if the eraser is heavy enough.

## A Koan

Zen Buddhist masters deliberately tried to confuse their students by giving them riddles with no answers. These riddles, called koans, were something like this:

what is the sound of one hand clapping?

Maybe if your hand was as thin as a leaf, you would have the answer to the koan. Which is: the same as the sound of one leaf flapping.



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## Fluttering Caused by Air Flow

When you spin the Hum around, the air flow makes the paper flutter and vibrate. This produces a sound. As you spin faster, the separate sounds become a continuous hum. Can you explain why?

### Try

Use different kinds of paper. You could even try it with a piece from a thin polythene bag. Does the sound vary with the thickness of the material? In what way?

### Think

How do bees buzz?

Hint: humming birds hum with their wings.



## A New Year Gift

Last year a friend sent us the Hum as a New Year gift. We suggested to the children in our workshop that they make the Hum to give away. To our surprise, our suggestion met with little enthusiasm. The children said that they neither liked to give, nor receive, home-made gifts. Such presents were not 'real', unlike bought toys.

What the children said was true—even if a child is persuaded to spend time and creative energy in making a toy for a friend's birthday, how will the gift be received? To make a unique present for someone requires ideas, care, work and a willingness to set aside other priorities. Is this valued at all?

Money is the common denominator of value in today's culture, an attitude which adults pass on to children. Many toys are 'status toys': the more expensive the toy, the higher its perceived value. Often, this has little to do with the possibilities it opens up. Yet the toy industry and the media have a high stake in convincing us that expensive, beautifully packaged products are valuable in themselves.

To a large extent, we are unthinking participants in a culture which persuades us not only of the primacy of money as the indicator of value, but also of homogeneity as a desirable state.

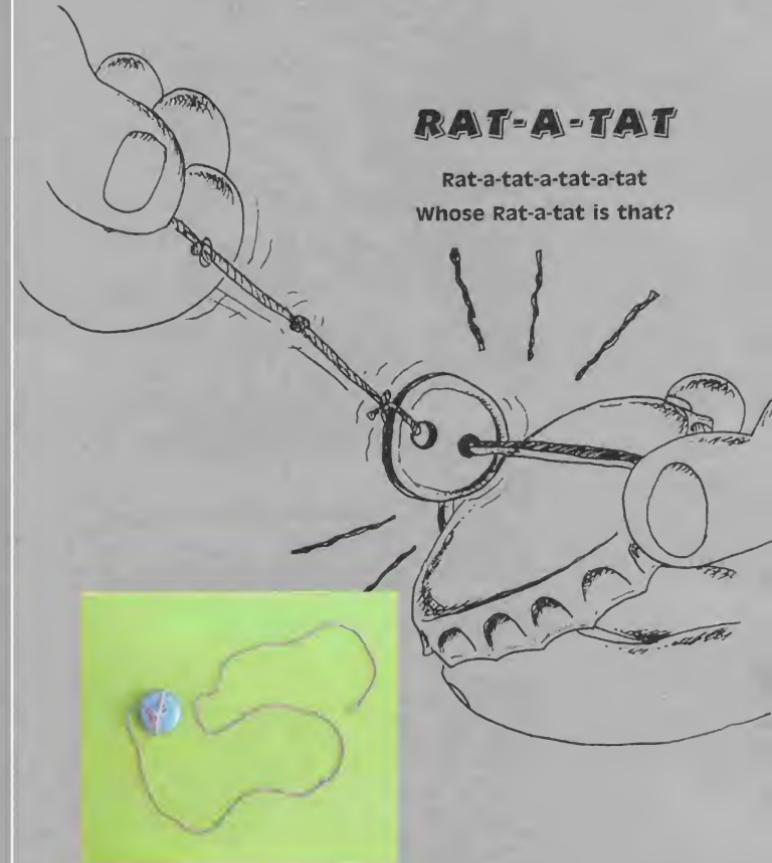
We are as afraid as our children of being different, of giving a home-made gift. Not only because this will make us appear cheap, but also because very few of us question messages we receive.

To be aware of this, examine it critically, and act accordingly costs some energy. But it is worth persuading a child to make a toy to give away, and to receive such gifts with the care and respect they deserve. This kind of positive adult intervention is necessary to help children exercise real choice, and not give in to mindless consumerist pressure.

Market forces are naturally out to persuade us that freedom lies in an increase in the number of goods we can buy. But real democracy comes with the freedom to make choices which are not dictated by the marketplace.



YUCK! A home-made toy!



## RAT-A-TAT

Rat-a-tat-a-tat-a-tat

Whose Rat-a-tat is that?

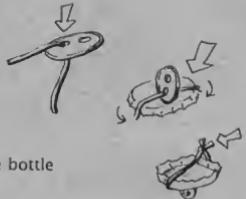
## Rat-a-tat

### What it is made of

- ◆ A rubber band
- ◆ A button
- ◆ A bottle cap
- ◆ String, 30 cm

### How it is made

1. Cut the rubber band and pass it through one of the button holes.



2. Tie the rubber band around the bottle cap with the button at the top.



3. Tie a string to the button, and make many knots along it.



### What it does

Hold the bottle cap in one hand and gently pull the string with the other, running your fingers over the knots, from one end to the other. Rat-a-tat! Each one makes a different noise.

### When it doesn't

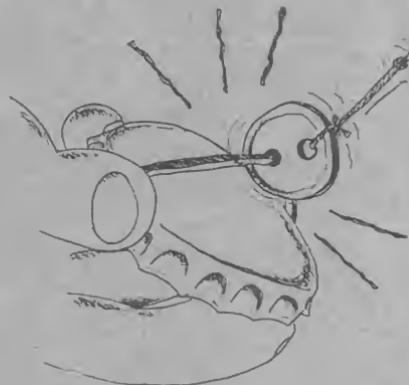
Are the knots big enough? Are they too far apart or too close? Don't move your fingers too slow or too fast. Check if the rubber band is tight.

## The Penguin Game

When a baby penguin is born, the mother penguin gives a loud cry. From a crowd of penguins that look exactly alike, the baby recognises its mother by her cry, and goes to her to be fed.

Every Rat-a-tat makes a different noise. Imagine that each of the Rat-a-tats is a mother penguin. The owner of the toy is the baby. Now one of you gather all the mother penguins and make them go "rat-a-tat" one by one. How many of the baby penguins can recognise their mothers by the sound?

When we played this game, only one baby penguin could not recognise his mother. Lucky he wasn't a real penguin, or he would have starved.



## Conversion of Mechanical Energy to Sound

When you run your finger over the string and reach a knot, your finger gets jammed at the knot due to friction and the rubber band gets pulled. When you pull your finger past the knot, the tension in the rubber band is released. The elastic energy in the stretched rubber band is converted to kinetic energy that causes the button to snap back into place. The kinetic energy is then converted to sound energy, in other words, a loud 'rat'. This happens again and again at each knot, so you get a rat-a-tat.

### Try

Why is the sound of each Rat-a-tat different?

Change the number of knots, the size of the knots and the distance between them, and note how it affects the sound.

Tie the rubber band tighter and see if the sound changes.

Use different kinds of bottle caps and buttons: metal, plastic, big and small.

### Think

What is the relationship between the sound of the Rat-a-tat and the sizes of the knots?

Hint: when the knots are bigger, the rubber band gets stretched tighter.

While we played the Penguin game, we didn't expect more than a few children to recognise their 'mother'. All the Rat-a-tats seemed to sound alike. To our great surprise, almost all the children managed to recognize the sound of their own toys. These were children who are usually told that they don't pay attention.

Obviously, the quality of attention and response had a great deal to do with the children's interaction with something they had created themselves. They knew it intimately and responded to it individually.

A bewildering number of toys, video games and multimedia products today claim to be 'interactive'. They range from fairly well conceived educational packages to a huge array of video games. We decided to look closely at a widely available product: popular video and computer games, and find out in what way they were interactive.

A majority of them have a generally violent story in place, with a defined enemy and strict rules of play. The stories usually centre around killing or destroying an enemy. How does a player interact with such a game? What is required of him?

Mainly speed of response. The solutions are all in place, and excelling at the game requires the player to react quickly, until the response is almost an unthinking reflex. The player plays less attention, rather than more, the better he gets at the game. It is a little like learning to cycle. The difference is that once on the bicycle, a person has the freedom to go where he pleases.

## True Interaction

But in this kind of game, the player cannot try out original solutions to the plot. Interactivity here has little to do with dialogue. Resolutions which are not part of the given scheme are not available.

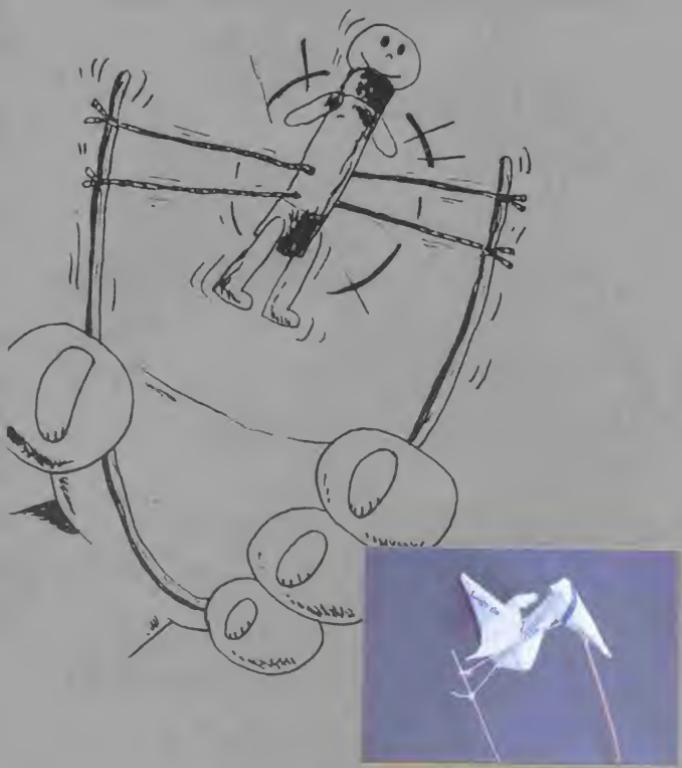
Hours of play certainly speed up a player's hand-eye co-ordination, and certain mechanical skills. But what can he do with these skills? Play newer, faster video games.



Where am I?



Toys that Dance



## BREAK-DANCER

Head over heels  
 This dancer reels  
 If he's not careful  
 He'll throw up his meals.

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### Break-dancer

#### What it is made of

- ◆ An empty thread reel
- ◆ Chart paper, as needed
- ◆ A thin and flexible stick, 35 cm
- ◆ 2 pieces of string, 25 cm each

#### How it is made

1. Make two holes through the reel, one below the other, fairly close together. The holes should not be too close to the centre.



2. Pass two pieces of string, one through each of the holes.



3. Bend the stick into a U. Tie the ends of the two strings to one arm of the U. Then tie the other ends to the other arm. Make sure that the longer part of the reel is towards the top and the holes are near the bottom.



4. Of course, this doesn't look like a Break-dancer yet. Paint a face and body on the reel or make a head, hands and legs of chart paper and glue them onto the reel.



## What it does

Gently press the two sides of the U together and release them. The Break-dancer flips over, performing amazing feats.



## When it doesn't

Is the string stretched tightly enough? If it is loose, the dancer falls sloppily and does not flip over. Check again if the holes are near the base of the reel.

If you are using a bamboo stick, use the outer layer of the bamboo. It bends easily because it is fibrous and flexible. The inner part has short fibres and snaps in two when you try to bend it.

## Thirst Prize

Instead of an acrobat make a crow with a long neck. To do this, all you have to do is attach two more reels on top of the first one. You could glue them on, or easier still, wedge a roll of paper into the first one, leaving a bit of the roll jutting out. Then push the next reel over the part that is sticking out. Do the same with the third reel. To make the whole thing look like a crow, add a beak and a tail. You could also paint it black, if you are particular. When you press the U-shaped stick, the crow dips its head.

Now fill a bottle-cap with water and place it on the floor. Let each of your friends try to make the crow drink the water. The one who does it in the least number of tries wins the game.

The winner gets a glass of water—as thirst prize.

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## Centre of Gravity

The reel is held up because of the tension ( $T_1$  and  $T_2$ ) in the strings. The weight ( $F_g$ ) of the reel acts downwards at the centre of gravity (Fig. 1). When you press the two sides of the stick, the tension in the strings is released. The strings become slack. The reel falls until it reaches a position at which the centre of gravity is the lowest (Fig. 2). When you release the pressure on the stick, the tension acts on the strings again. The tension along the upper string pulls the lower part of the reel upwards and the tension along the lower string pulls the upper part downwards. The reel flips back into its initial position.

### Try

Traditionally, this toy was made of shola-pith, a light but firm material found inside the stems of some plants. You could use wooden ice-cream spoons, glued together, with the strings passing between them.

### Think

The 'Law of Conservation of Energy' states that energy can neither be created nor destroyed. How is this law applied in the Break-dancer?

Hint: elastic energy or tension is converted to kinetic energy and vice versa.

What would happen if the two holes were near the top of the reel? Would the Break-dancer dance then? And what if the holes were exactly at the centre of the reel?

Hint: when an object is not balanced, it tries to reach a position at which its centre of gravity is the lowest.

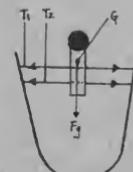


Fig. 1

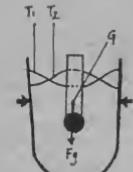


Fig. 2



## A Material Difference

The Break-dancer is our variation of a traditional acrobat toy made with thin bamboo and string. Our experiments with other material like wood and wire didn't work as well. We realised that the Break-dancer got its characteristic movement from the properties of bamboo—its flexibility and elasticity. The folk toy arises from the material at hand: each toy uses locally available ones intelligently.

We discovered later that a European version of the traditional Indian acrobat toy was made of wooden sticks, since bamboo was not available in Europe.

One of the primary gains for a child making her own folk toy is the direct experience of materials, learning to observe and experiment with locally available ones. To make toys which work involves an understanding of material properties—an understanding based on tactile, not merely cerebral intelligence.

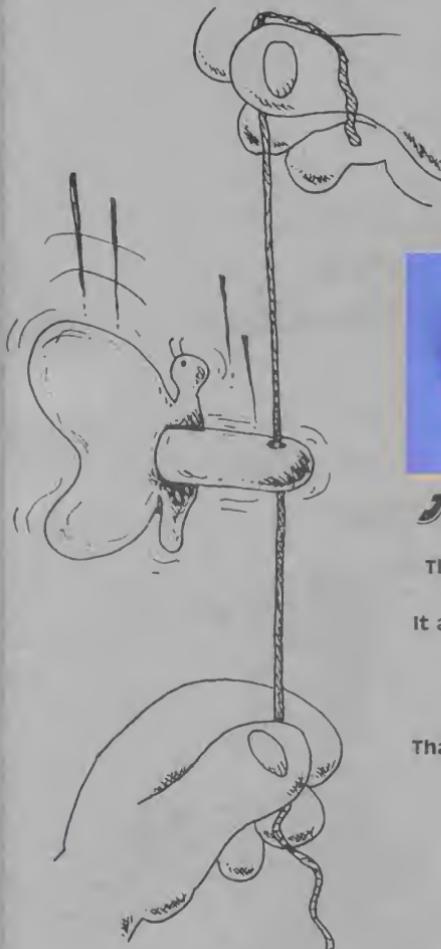
Earlier, children used to do this all the time, making their own catapults, bows and arrows or kites. But today's wealthy urban child is a consumer of finished goods. The toy is a product made in factories, by experts. The inventive possibilities in everyday material are no longer part of children's creative lives. This leads to a disregard and even contempt for simple things around them.

We noticed during our workshop that children from poorer schools had a more attentive, playful and inventive attitude towards materials. They threw nothing away. This is an ironic commentary on conventional notions of progress and development. Today it is only the child without means, who cannot buy and play

with anything 'better', who still has the freedom to look around at what is available and see what it can be turned into.



Target practice with stones and coins



## JITTER-BUG

The Jitter-bug is an odd sort of critter

It always seems to be in a twitter

Shiver and shake

Quiver and quake

That is the way the Jitter-bugs jitter.

# 12

## Jitter-bug

### What it is made of

- ◆ A small lump of clay
- ◆ A piece of string, 50 cm
- ◆ Chart paper or thin cardboard
- ◆ Paints or colour pencils
- ◆ Glue

### How it is made

1. Make a small bullet out of the clay.



2. Make a hole and a cut as shown. Let it dry.



3. Pass the string through the hole. You could tie a button at each end of the string so that the bullet does not slip through it.



4. Cut out the chart paper in the shape of a butterfly, or any other shape, and glue it into the cut on the bullet.



### What it does

Hold the string vertically and stretch it tight. The Jitter-bug jitters its way down.

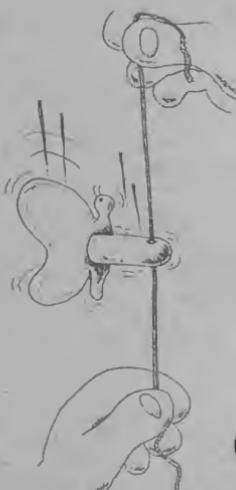
### When it doesn't

Check if the hole in the clay bullet is too big. If it is, the Jitter-bug will slide down quickly. If it is too small, it will get stuck and won't be able to move at all.

## The Jittery Monkey

On a piece of chart paper, paint a coconut tree with coconuts on it. Cut it out and stick it to the upper end of the string. Then paint a monkey on another piece of chart paper. Cut it out and glue it onto the clay bullet.

The nervous monkey can never get the coconuts. Every time he reaches the top, he gets the jitters, and comes jerking down again.



## Friction and Elasticity

When you hold the string taut the clay bullet first slips down a bit. Then, the weight of the bullet ( $F_g$ ), acting at the centre of gravity (G), causes the bullet to tilt (Fig. 1). When it tilts, it stops moving downwards because of the friction acting on the string at the hole. The string is bent out of shape. This happens because of the elasticity of the string. The tension (T) pulls the string back into shape (Fig. 2). The bullet now jerks upwards so it slides down a little, before the gravitational force acting at G tilts it again. The process is repeated as the jitter-bug moves downwards.

### Try

Use a shuttle cock instead of the clay and chart paper. Does this work?

Try using a thick metal wire instead of the string. What happens?

What if you use a spring in place of the clay bullet?

### Think

Which of these will jitter? Fig. 3 or Fig. 4?

Can you think of a way to make the bullet in Fig. 4?

Hint: shift the centre of gravity to one side.

Broad hint: add some weight at one end.

If you attach something flat and horizontal to the clay bullet, the air resistance acts upwards on it and prevents it from jerking. So it comes down slowly.

Can you think of something that works on the same principle?

Hint: what would you wish you had if you fell off a plane? A telephone? A book? A parachute?

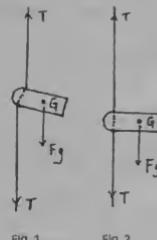


Fig. 1      Fig. 2



Fig. 3      Fig. 4



## Play and Learning



Stuff of early learning?

A child decided to turn the jitter-bug into a snake. At first, the snake didn't dance—it just slid down. After a lot of experimentation, the toy finally did what it was supposed to; it jerked all the way down the string. Why? Once he had figured this out, the child went on to make the spontaneous connection between his toy and a parachute descending through the air.

We saw that the struggle to make his toy work allowed the child an insight into abstract physical principles. The understanding came through play. Such insights are frequently arrived at in a tangential way, and almost always open up wider areas of experience.

Learning is an important aspect of play. There are entire systems of education, like the Montessori method, based on creative learning through play. When they play with a ball, young children develop co-ordination, recognition of rules and communication with others. But is that all?

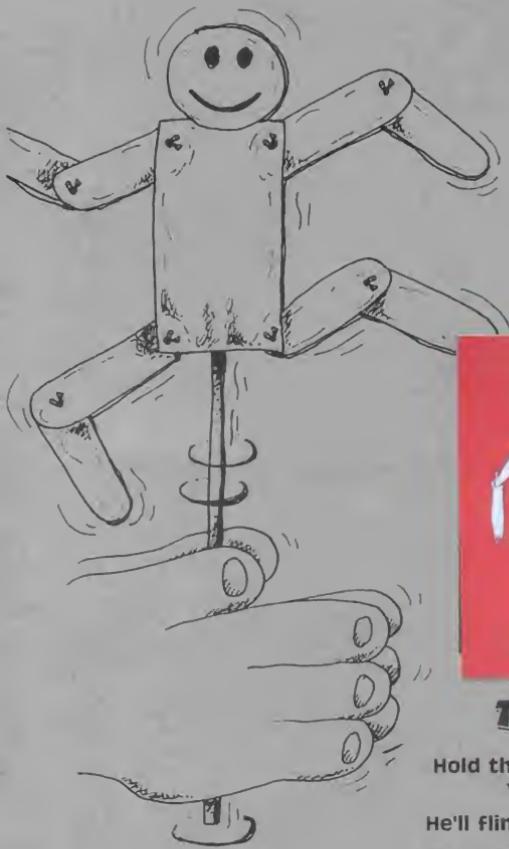
There is a lot more to the experience, when play is free and unstructured. During such free play, learning is not the main focus—it is incidental, and has more to do with an intangible inner movement towards understanding. The relationship between play and this kind of deep learning is complex and indirect.

In today's competitive environment, many parents are eager that their children 'learn' more, at an ever earlier age. Unfortunately, the kind of learning they want for their child is less about opening up wider areas. It is directed more towards doing better at school. Play and educational toys then become a means to this end.

Sadly, the child's time then begins to be structured and directed in very restrictive ways, with parents encouraging anything 'educational' and devaluing other kinds of free play.

Educational toys range from simple blocks and puzzles, to word games and chemistry sets. How do we evaluate them? One way would be to see how far they recognize the indirect and complex relationship between activity and learning.

We need to be wary of rigid approaches—like games which merely reinforce school lessons or CD-ROM's which teach pre-schoolers mathematics. While parents are prepared to pay any amount for toys which they perceive as relevant to their child's future career, they forget about the other equally important kinds of play she needs.



## ***TWIST***

**Hold the Twist and turn  
your wrist**

**He'll fling his limbs about  
Everyone says he has no  
grace  
He dances like a lout.**



# **12**

## **Twist**

### **What it is made of**

- ◆ String, as needed
- ◆ Chart paper, as needed
- ◆ Glue
- ◆ A stick, 25 cm
- ◆ Paints or colour pencils

### **How it is made**

1. Keep the two sheets of chart paper one on top of the other. Draw the various parts of the puppet's body—the head, the body, legs and arms—on the chart paper.

2. Cut out the parts and make holes as shown.



3. Glue the two layers of the head, legs and arms together. You can paste on extra layers at the feet and palms, to make them heavy.



4. Glue the head firmly to the body. Slip the legs and arms between the two layers of the body. Pass the strings through the holes and knot them on either side. The knotted strings act as pivots, around which the arms and legs can move freely.



5. Now push the stick between the two layers of the body, then glue the two layers together.

## What it does

Hold the stick between your palms and twist it with a jerk. The Twist will do a wild jig.



## When it doesn't

First, check if the limbs are loosely jointed. If they are tightly tied at the joints, they won't move. The ends of the limbs should be slightly heavy. If you want the Twist to twist wildly, make the limbs really long.

## The Sad Clown: a Story for a Puppet Show Using the Twist

All the children at the workshop made different Twists. One child made a clown, another child made a skeleton, someone made a man whose head looked like the head of a lizard. A child came up with the idea of doing a puppet show using all these odd characters. They made up a story:

In a circus, there was a gloomy clown. When people saw him, they felt so sad, that instead of laughing, they cried. The ringmaster announced that anyone who made the clown happy would get a free ticket to the circus. One by one, many characters arrived—a monkey, a skeleton, a crab—and tried to make the clown laugh. But he just cried and cried.

Finally, the ringmaster showed him a mirror. The clown saw his own face.

"That's the funniest thing I've ever seen", he said and began to chuckle. "I've never seen such a funny face in all my life!" He rolled on the floor with laughter.

The audience clapped. The whole thing was part of the circus show.

You could make up your own story and do a puppet show with your Twists.

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## Centrifugal Force

When the stick is twisted, the circular movement creates a centrifugal force ( $F_c$ ). This force acts on the limbs, pulling them outwards (Fig. 1). The centrifugal force acting on an object depends upon the mass ( $m$ ) of the object, and the velocity or speed of the rotation.

### Try

Twist the stick fast and slow, and see how it affects the movement of the limbs.

Make the limbs longer. Does the Twist become a better dancer or does it make him more loutish?

Hint: centrifugal force is inversely proportional to the radius ( $r$ ) along which it acts.

### Think

Can you guess why the Twist dances better if the limbs are heavy at the ends?

Hint: the centrifugal force acting on an object is directly proportional to the mass of the object.

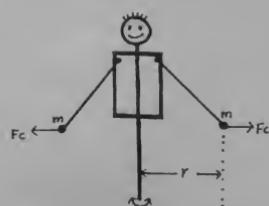


Fig. 1



## Truly Boring



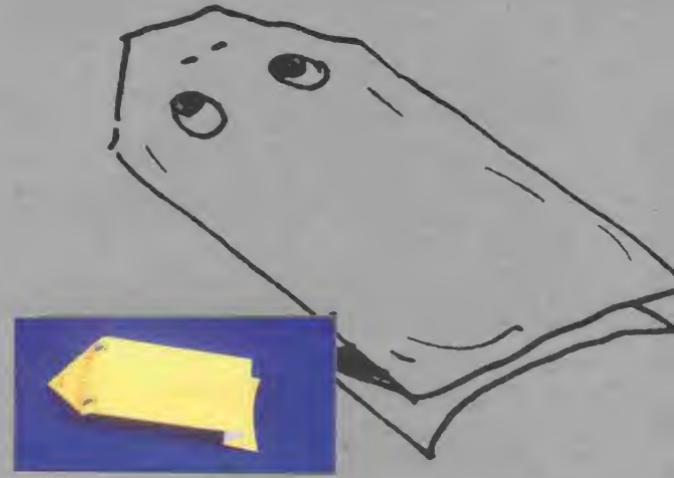
"Wonder what's on Channel 37..."

After the children had played with their toys for a while, many of them began to feel bored and distracted. We did nothing about it. Finally, one of them came up with the idea of putting up a puppet show with the Twists. The bored players turned themselves into active entertainers. It occurred to us that there is a positive value to being truly bored. It leaves you with no choice but to find a way out of it, using your own resources.

Can children today actually do this? More and more, their worlds mimic those of adults. Every available instant is filled, either with the stress of work or with readymade entertainment. Many adults feel that there is nothing wrong with this. Doesn't the child overburdened with school work need to relax in his leisure time?

The problem is that leisure has come to mean only passive time-filling. When a child is entertained, he merely consumes. The fantasy, imagination, and creativity are all other people's. When something gets boring, all he needs to do is switch TV channels. With little need to exert himself to do anything else about it, the child's ideal of a good time is to let others keep him occupied, warding off boredom at all cost.

On the other hand, active play, particularly when it gets boring, induces the child to move off in a new, random direction. It is this quality of play which turns dead-end situations like the one we had into take-off points for invention.



## BE-BOP

There was a young frog called Flip-flop  
He was learning to leap and to hop  
But when he went for a race  
He couldn't keep pace  
So instead he danced the Be-bop.

**Be-bop****What it is made of**

- ◆ The inner flap of a cigarette box

**How it is made**

1. Fold one end of the flap as shown.



2. Fold the other end to make the head.



3. Turn it over and paint eyes on the head if you like.

**What it does**

Tap the Be-bop on its rear end, to make it leap forward.

**When it doesn't**

The fold at the back has to act like a spring. If you press the folds down too flat, it may not work.

**Frog Race**

Line up all the Be-bops. Draw a finishing line. On getting the start signal, all the Be-bops must leap towards the finishing line.

The Be-bops that turn turtle are disqualified—no turtles allowed in a Be-bop race.

**Conversion of Stored Energy into Kinetic Energy**

The double fold acts like a spring. When you press it, the force you apply is stored as elastic deformation energy. When it is released suddenly, the energy is converted to kinetic energy and the Be-bop leaps up.

**Try**

You don't need a cigarette flap to make this toy. Try making the Be-bop with different kinds of paper.

**Think**

Will the Be-bop leap if it is made of cardboard? Why not?





## Contemporary Tradition

Does a folk toy really use the inside flap of a cigarette carton as raw material? Don't these toys always use traditional materials like bamboo, clay or pith?

We looked again at our collection of original folk toys, and to our surprise, discovered that many of them were made with recycled objects like bottle caps, tin cans, bicycle spokes, or springs from ball point pens.

These materials don't fit in with most people's idea of 'folk', and we thought about why this was so. We tend to think of folk as tradition. And tradition, in our minds, is associated with the past, with pure unchanging ways of doing things, handed down through generations.

In reality, traditions change and evolve, through time and through contact with others. In fact the more a tradition is willing to engage creatively with change, the more vibrant it is.

In many ways, folk toymaking has done this. It uses contemporary material in a completely unselfconscious way. As far as toymakers are concerned, the rules on what can and cannot be used are flexible. With many traditional raw materials no longer cheaply available to them, they have simply looked around, and creatively recycled everyday material into new uses.

The survival of folk toymaking rests largely on its capacity for innovation. Artisans innovate in order to survive, so they have managed to stay contemporary.

Folk toys are in danger of dying out not because they are outmoded, but because they do not have the backing of capital and infrastructure.



Monkey from a sweet box bounces down a bicycle spoke on a ball-point pen spring



## ROCK-N-ROLL

Push or shove or biff or bop  
Rock-n-roll will never drop.

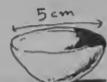
## Rock-n-roll

### What it is made of

- ◆ Clay
- ◆ Glue
- ◆ A piece of paper, 10 x 20 cm
- ◆ Paints or colour pencils

### How it is made

1. Make a small, shallow bowl out of the clay, about 5 cm in diameter and 2 cm high. Let it dry.



2. Paint a face on the paper. You could also paint something else—a face with a body, or even a geometrical design.



3. Paste the paper along the rim of the bowl, to make a cylinder.



4. Make a paper cap and glue it on top.



### What it does

Give the Rock-n-roll a little push, and it will begin to rock back and forth. Push it hard, and see if you can make it fall.

### When it doesn't

Does it fall off to a side instead of rocking? Maybe it is too heavy on top. Or is the paper cylinder too long? Try cutting it shorter. The bowl should be shallow, with a smooth base. If it is deep, it won't be stable and will topple over easily.

### Son of an Owl?

In North India the name given to this toy is 'ullu ka pattha' which means 'son of an owl'. A stubborn person is often called 'ullu ka pattha'. The toy is considered a stubborn and unreasonable character because it refuses to fall.

But what is so unreasonable about refusing to fall? Even if it is, why call it an owl? Are owls unreasonable?

It doesn't seem fair to the toy or to owls, to call this the son of an owl. We hope you'll be more reasonable when you name your Rock-n-roll.



## Stable Position

Can you guess why this toy rocks?

When the bowl is in its stable position (Fig. 1) the weight of the pot ( $F_g$ ) acts downwards through the centre of gravity (G), which is at its lowest point.

According to Newton's third law of motion, when one object applies a force on another, the second object exerts an equal and opposite force of reaction on the first.

So the floor exerts an equal and opposite force of reaction ( $F_r$ ) on the bowl at the supporting position (B).

The two forces  $F_g$  and  $F_r$  act in opposite directions along the same line, so the bowl is stable in this position. The centre of curvature (C) of the bowl also lies on the same line.

When the bowl is tilted, the base touches the floor at a new point (B1) (Fig. 2).  $F_r$  now acts upwards through B1, while  $F_g$  still pulls downwards through G. These two forces together result in an anti-clockwise movement. When it reaches its stable position, it swings beyond, because of the momentum it has gathered.

### Try

Make a deep bowl, and try to make it rock. If it is really deep, it will not tilt back. Can you figure out why?

Hint: draw a similar diagram. The centre of gravity (G) is much higher, and B1 is to its left, so the resultant movement will be clockwise.

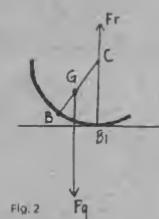
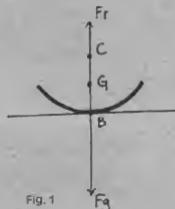
Make the upper cylinder long and heavy, and give the Rock-n-roll a push. Will it rock?

Hint: If the top is heavy, the centre of gravity is at a higher point.

### Think

Why does a ball roll?

The centre of gravity of the ball is at its centre. That means, whichever way you turn it, the centre of gravity is always exactly above the point at which it touches the floor.



## Magic and the Mystery of Function

We made the Rock-n-roll with a group of children of different ages. Initially, we wondered whether the older ones would enjoy creating this toy for very young children. Their enthusiasm was a surprise.

Our doubt came from the fact that children grow out of certain kinds of play. Toys in the market are graded according to age levels, and older children do not generally play with 'baby' toys. The toy industry consciously promotes this, since it increases the manufacture and sale of more toys. Children today 'outgrow' their toys much more rapidly than ever before.

In all this, we forget that there have always been traditional playthings—like kites—which children of different ages have played with, at varied levels of complexity.

There is positive value in this, particularly when the children make the toy themselves, as we discovered when we made the Rock-n-roll. The experience was enjoyed by children of different age groups, for completely different reasons.

For young children, the excitement was simply in making and playing with a toy which rocked to and fro without tipping over. The experience was complete in itself, it required no further explanation. Some of them listened to our scientific analysis of why the toy functioned, but didn't really take it in.

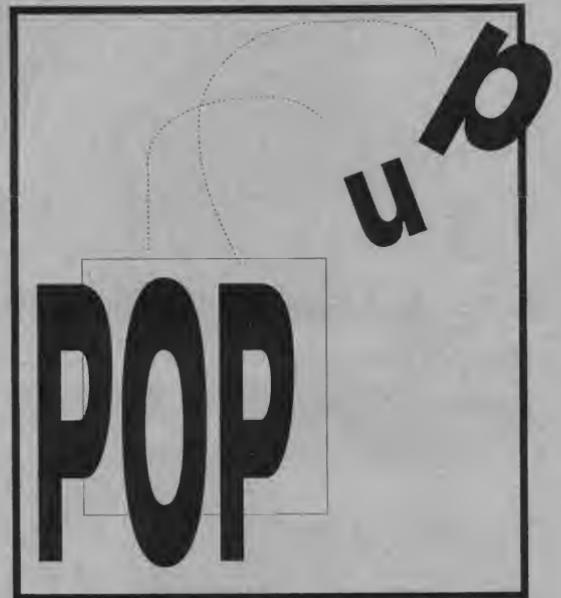
On the other hand, how and why the toy worked was its precise fascination for older children who had outgrown the stage of playing with it. Here was a concrete manifestation of principles of physics they had learned as abstractions in the classroom.

Older children are interested in causation in more realistic, logical, and sometimes sadly, in more conventional ways. Solving the mystery of the Rock-n-roll's function was a way of making its movement more predictable, less magical. Their delight was in understanding the relationship between structure and principles, in grasping the connection between weight, balance and the centre of gravity.

For us, these observations led to a very important insight: that the same experience can mean very different things, seen from different perspectives. This initiated the concept behind this multi-level book.



What was that?



Toys which Play Tricks



## CLAP-TRAP

Find an unsuspecting chap

Trap him with a startling clap.

### Clap-trap

#### What it is made of

- ◆ Two cardboard pieces, 4 x 5 cm each
- ◆ A rubber band

#### How it is made

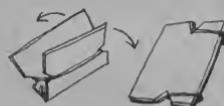
1. Take the two cards, and make notches on two sides.



2. Place the two cards together and stretch the rubber band over them, along the notches.



3. Gently open the cards, like a book. See that the rubber band doesn't snap. Fold the cards in the opposite direction and hold them tight. The trap is set to spring.



#### What it does

Throw the Clap-trap into the air. It jumps with a loud clap, making your friends leap in fright.



## When it doesn't

If the rubber band is taut enough, and the cardboard is thick enough, it does.

## A Practical Joke

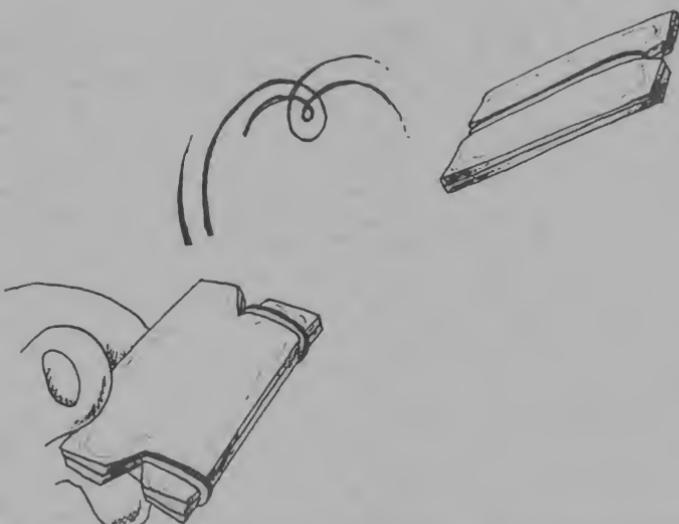
Owner of Clap-trap: Hey, look at my book.

Friend: Let me see it!

Owner of Clap-trap: Catch!

Pattack!!!

Friend jumps several feet high.



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## Conversion of Kinetic Energy into Sound

It is quite obvious that the noise is produced because the two pieces of cardboard clap against each other. Once you make the toy, it is also clear that it is the rubber band that causes the clapping. But how?

When the rubber band is stretched, it stores energy. This is called elastic energy. When the Clap-trap is thrown, the elastic energy is converted to kinetic energy. This causes the two cards to leap into the air and flip over to their original position. The kinetic energy is then converted to sound energy, which is why you hear the clap.

### Try

Make the Clap-trap with a loose rubber band and a tight one. What difference do you notice? Can you explain the difference?

Hint: the greater the tension in the rubber band, the more the elastic energy.

### Think

In the Clap-trap, stored elastic energy (the tension in the rubber band) is converted to kinetic energy (the leaping book) and sound energy (the clap). Energy never gets destroyed, so where did it come from in the first place?

Hint: who stretched the rubber band?

## Playing a Practical Joke

The children who made the Clap-trap devised elaborate practical jokes, surprising the rest of the school with sudden noises. Most adults were annoyed.

Child victims, on the other hand, were more sporting, and ready to join in. Children, more than adults, are more likely to enjoy fun which appears pointless. There is nothing to be gained from playing a practical joke, except fun. There is nothing to lose either, if the victim is a sporting one.

The practical joke stands somewhere between play and entertainment. It consists as much of action as of words, and is participatory, for both the joker and the victim. Like many forms of entertainment, a practical joke needs preparation and a script of sorts, for maximum effect.

One of us thought of an elaborate joke he had played on a teacher at school. He peeled a grape and carefully carried the white pulp to school. At an appropriate moment, he clapped the grape pulp to his eye. When the teacher looked his way, he dropped the grape, clapped a hand over the eye and shouted: "Oww! My eye! I think my eye fell out!"

His teacher actually helped him try to put the thing back, before she realised what was happening.

What did the joker gain from this intricate plan? Merely fun. When we thought about it, there is nothing 'mere' about having fun or generating it.

A playful personality has a lot to do with it. It involves a tolerance of chaos, and an abandonment of logic. Most importantly, the lack of a goal when trying out something. In the case of a practical joke, the only goal is the victim's surprise.



Monkey business



## FLOWER-POWER

It comes and goes  
This mystery flower  
Does it have some  
Magic power?

## Flower-power

### What it is made of

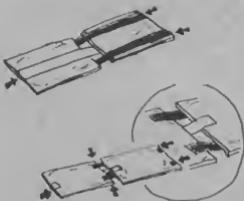
- ◆ 2 cardboard pieces, 7 x 9 cm each
- ◆ Stiff paper or cloth, 14 cm
- ◆ Coloured kite paper
- ◆ Glue

### How it is made

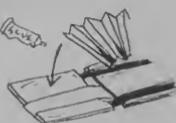
1. Take a rectangular piece of kite paper. The length should be about three times the breadth. Fold it in an accordion fold.



2. Keep the two cards side by side along the shorter side. Cut out three strips of thick paper or cloth, about 14 cm long. Place two strips about 3 cm apart on the first card, with the ends going under the second card. Place one strip on the second card, with the end going under the first.



3. Turn the cards over and glue the ends in place, as shown. There should be at least a centimetre of space between the two cards.



4. Flip the cards again, and glue one edge of the paper fan to the centre of the single strip of paper or cloth, and the other edge to the centre of the other card.



5. The strips act as hinges, so the two cards can now be opened like a book, from both sides.



### What it does

Hold one card and release the other card, letting it fall open. Take care to show the side where the flower is hidden. Then holding the lower card, quickly let the upper card fall back, and flip it downwards: Flower-power!



### When it doesn't

Check if the hinges are fixed the right way. If they are okay, there is only one thing that can go wrong: the flower that is supposed to be hidden is quickly spotted by the audience. This would ruin the show, so make the fan narrow, and use thin paper that will not bulge.

You need to be quick and cunning. Distract the audience by talking and waving your arms about. It would also help to seat the audience at a distance.

### Magic Show

You can gross out your friends with this magic show. Cut out the cardboard pieces in the shape of an apple, and instead of a flower, put in a folded strip of paper which looks like a worm.

First open the apple on the good side, where the worm cannot be seen, and show it to your audience.

You: Isn't it a nice apple?

Audience: Yes! Yes!

You: Would you like to eat it?

Audience: Yes! Yes!

When their mouths have started watering, flip over the apple. Out pops the worm.

Audience: Aaargh!

#### Variations on Flower-power

- ◆ Worm in a garden
- ◆ Smiling/frowning face
- ◆ Flowers on both sides
- ◆ Family tree
- ◆ Storyboard: a different story on each side



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#### Two-way Hinge

The three strips of paper act like two-way hinges. So the two cards can be opened on either side.

#### Try

Can you make this with four, six and eight cards?

#### Think

What is the difference between the hinge in this toy and a door-hinge?



Flower-power multiplied



## Magic

The unanalysable charm of this toy was that even though the children had made it themselves, there was still an element of wonder every time they showed it to a friend. The magic worked on the magician, as much as on the audience.

Magic is the opposite of rational explanation. A small child's way of making sense of the world contains a lot of magical thought. As she gets older, she looks for more objective explanations.

But the two ways of apprehending reality—the magical and the rational—continue to co-exist and flow in and out of each other, even as children grow older.

Their sense of magic is discontinuous: children can be quite objective in their understanding of how things work one moment, and suspend rationality the next. This toy captured the essence of that ambiguity.

Participation in this kind of magic is less available to today's child. More children are familiar with the robot than with the genie of Arabian Nights. But while they marvel at technological magic, they can only take part in it, never be the ultimate creator.

For the children in our workshop, creating their own trick and practising it on their friends brought back a sense of magic which the contemporary child is losing.



Got it?



## POP-UP

The Pop-up  
Needs no prop-up  
Just some chop-up  
Glue-up, mop-up  
It'll crop-up  
With no flop-up.

## Pop-up

### What it is made of

- ◆ Chart paper or two pages of a glossy magazine
- ◆ Coloured kite paper, as needed
- ◆ String, as needed
- ◆ Glue

### How it is made

1. Make two tubes out of the chart paper, in such a way that one can slip into the other. The wide tube should be less than half the length of the narrow one.



2. Cut out a rectangle of thin coloured paper. The length should be about six times the width. Fold the paper to make a fan.



3. Glue two pieces of string along the two extreme folds of the fan.



4. Now glue the fan into the thinner tube.



5. Slip the narrow tube into the wide one, and glue the loose ends of the strings to the outer tube, in such a way that when the inner tube is pushed out, the string becomes taut, and the fan is fully unfolded. Before sticking them on, check to see that the tube can slide in and out easily.



6. Cover the outer tube with bright paper, so that the string is covered up.



### What it does

Show the tube to your friends. Ask them what it is, a pen? A trumpet? Then mutter something and swish your arms around to distract them, and when they are not watching, push the inner tube out from below. The fan pops up, amazing the open-mouthed audience.

### When it doesn't

If the fan is too thick, it might get stuck in the tube. Either the tube should be widened, or the fan should be made thinner. It is always best to practise before you gather an audience, or your Pop-up might be a flop-up.

### Hair Today Gone Tomorrow

Somebody made a Pop-up with a face, and pink hair that popped up and down. We called him Bald-E and made up a mad story about him:

The Nohair tribe had a chief called Shave-N. He declared that all the tribesfolk should be bald. "No hair, that's our motto."

His son was called Bald-E. Bald-E wanted to have long, flowing hair. He told his father he was going to see the world, and left home.

Actually, he went into the forest and grew his hair. Then he decided to go back to the village. His father was very angry to see his hair.

"Have you forgotten our motto?" he asked.

"No, but if you don't let me grow my hair, I will go away again," replied Bald-E.

His father did not want him to go, so he declared that the Nohairs could now grow their hair. Bald-E was thrilled. His hair grew and grew and grew.

Then one day a traveller came to the village. He gifted Bald-E a mirror. When Bald-E saw himself with pink hair he got such a fright that all his hair fell off.

"Oh well," he said sadly, as he buried his comb. "Hair today, gone tomorrow."

You can make up all kinds of stories for the toys that you make. Sit in a circle with your friends, and ask someone to start the story. Then the person next to her can continue it. Go round the circle, adding to the story one by one, and you'll come up with some weird stories for your toy.

13 ⇔ 16

## Folding and Unfolding

The object that pops up has two basic attributes.

It can be folded so that it fits into the tube.

When it pops out, it can open up fully. The string attached to the fan pulls the ends downwards, and the fan opens out.

### Try

Can you think of something other than a fan that can be used as a pop-up?

### Think

While making the fan, the length of the paper should be about six times the width. Can you figure out why?

Hint: the perimeter of the fan is  $2\pi r$ , where  $r$  is the width (radius) of the fan.  $\pi = 3.14$  (approx.)



A Tooth-paste Carton Monster pop-up



## Imagination and Imitation

We decided to start a story with the Pop-ups we made. Our tale created a world more bizarre and unpredictable than anything we were acquainted with. It was typical of the kind of imaginative leaps most children delight in.

The experience led us to think seriously about the quality of imaginative play today. When we asked the children about their favourite toys, one small girl immediately said "Barbie!"

It turned out that all the girls knew the storyline that went with the doll, and the elaborately detailed role of each character. They knew what Barbie liked to wear, what she liked to do, who her friends were ...

Given all these details, the child's imagination is channelled along very defined paths. The designer has already thought out the character, the storyline and the accessories which go with the doll. Promotions make sure that these are beamed at children repeatedly, through advertising and television tie-ups.

So when a child plays with this kind of doll, the play will necessarily tend towards an imitation of what she knows about the character and the story. Toys like Barbie are part of what can be called a closed system of play.

Apart from the lack of imaginative freedom, closed systems of play bring two other serious problems with them. One is the context in which a particular toy and its storyline are set. This is the world-view the child imitates, and to an extent, internalises.

Barbie, for instance, is not just another doll. Her sexy, plastic-pretty-ultra-feminine

personality, and the world she inhabits, capture the teenage ideals and fantasies of mainstream American society. Some Barbie dolls in India have her wearing Indian clothes.

But this does not in any way fundamentally alter the context and assumptions she brings with her. These are problematic in themselves. But they also belong to an alien society, and are not universal.

So the child playing with such a doll imitates actions and relationships which are neither freely imaginative, nor a significant part of the culture she actually lives in.

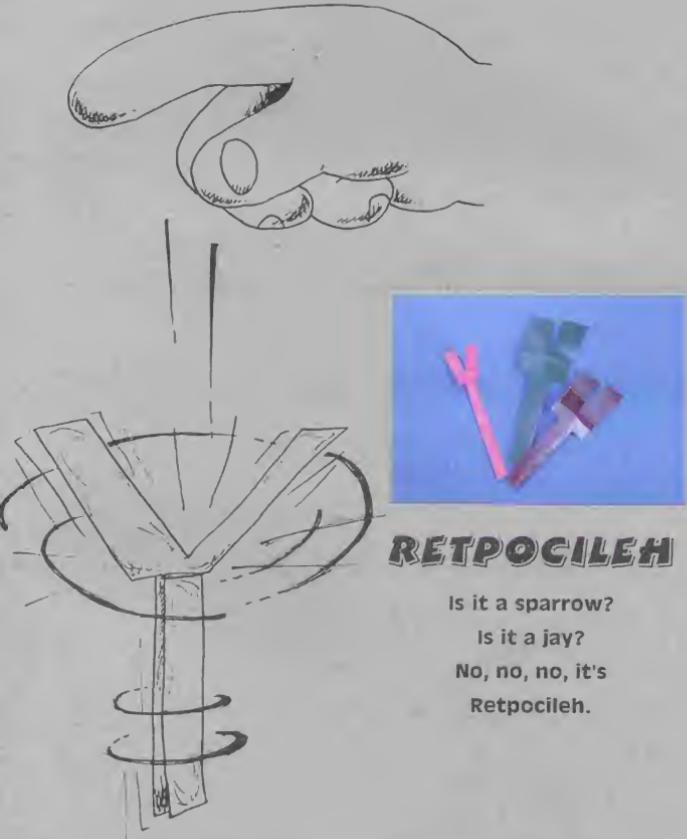
The second problem with toys within a closed system is that they exploit children's play in a way which primarily serves the needs of the market. For instance, products like clothes or accessories go with each character. Each product invariably fulfills a small specific need. Not only the key characters, but accessories that go with them are meant for a specific story. Other toys with other scenarios are needed for other play.

As a result, the child who wants to participate in this play becomes an easy victim of consumerism. When toys are less fixed, or can be used in many ways, people buy fewer ones.

We concluded that for children who play largely with these toys, play becomes less imaginative and more imitative. Sadly, it also turns into an entirely commodity-based activity.



## Toys that Move With the Wind



Is it a sparrow?

Is it a jay?

No, no, no, it's  
Retpocileh.

### Retpocileh

#### What it is made of

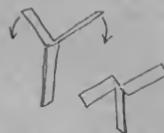
- ◆ A strip of paper, 8 x 2 cm

#### How it is made

1. Cut one long slit down half the length of the strip, and two small horizontal slits on two sides, about a centimetre below the vertical slit.



2. Fold the paper inwards on both sides, at the horizontal slits.



3. Fold the upper part out on opposite sides, as shown. These are the blades.



#### What it does

Fling your Retpocileh from a height and watch it twirl and descend. You can also accompany it with strange sounds if you like. Or else watch it silently.

#### When it doesn't

If your Retpocileh doesn't rotate, try changing the length of the blades and of the base.

## A Surprise

We decided to try out different kinds of Retpocilehs at home, using as many types of paper as possible and trying out all kinds of sizes. The next day, we had a surprise. A boy said, "Here is my Retpocileh, but I didn't have to make it. I suddenly remembered this seed, which spins just like a Retpocileh."

Then another child thought of oleander flowers. "Even they spin like this," she said.

13 ⇔ 16



## Turning Force: Vertical Axis

Do you know how a helicopter takes off? In a helicopter, the rotor blades rotate at great speed and push the air down. This force causes the machine to rise.

What happens in our creation? Just the opposite, actually. As it moves down, the air acting upwards causes the blades to rotate. That is why we call it a Retpocileh.

But why do the blades rotate? If you look carefully, you will see that the blades of the Retpocileh are slightly tilted. When it falls, air acts upwards on the blades. The loss in momentum of the wind causes a gain in momentum for the blade. The blades are inclined in opposite directions in relation to the axis. Therefore the momentum causes a turning force, which makes the blades rotate around the vertical axis.

### Try

Make a very large and a very small retpocileh. Can you figure out why they move differently?

Make the base heavy and see what happens. Make more slits for the blades and find out how and why the movement changes.

### Think

Why does the seed that looks like our Retpocileh need to fly?

Can you find other seeds which are dispersed using similar methods?

Why do you think the oleander flower spins? Maybe just for fun? Everything does not have to have a reason.



## Physics, Biology, Technology ... What is a Toy?

We thought about the ease with which a child saw the similarity between the way the Retpocileh worked and the spinning of a seed. The simplicity of the toy enabled the connection that a toy is an experience or idea, not merely a product.

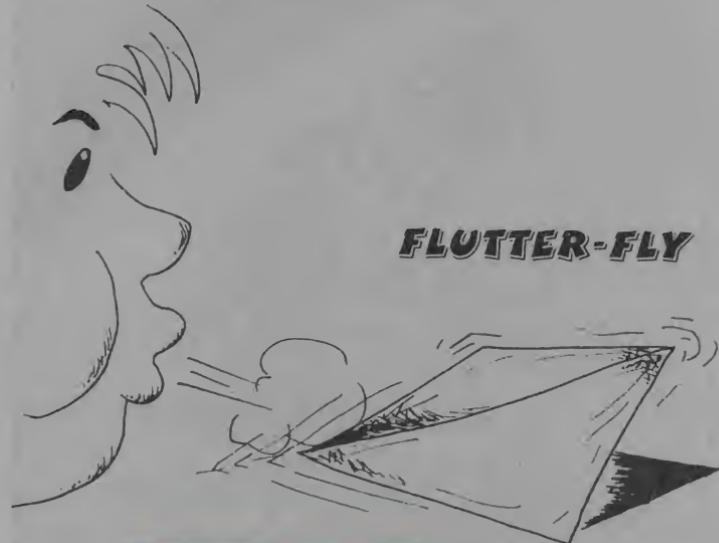
The children spontaneously began to think of all the natural objects they played with: burrs they threw on each other's clothing, milkweed seeds they exploded, floating canoes from fruit pods, balls made from the pulp of raintree seeds, water squirted from the African tulip fruit, winged seeds that flew ...

Anything, in fact, can be a toy, if we choose to describe what we do with it as play.

We thought of toys themselves as seeds, with everything in them: science, technology, material, design, play, relationships and cultures.



A burr in hand is worth two on a bush



## FLUTTER-FLY



Blow, blow, blow your breath  
Without a word or mutter  
Merrily, merrily, merrily, merrily  
Flutter-fly will flutter.

## Flutter-fly

### What it is made of

- ◆ A square piece of paper, 10 x 10 cm

### How it is made

1. Fold the paper along the diagonal to make a crease.



2. Decorate it, if you like, to make it look like a butterfly. Or you can cut it into a different shape. Only make sure it is symmetrical: when you fold it at the centre, the two sides should overlap exactly.

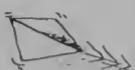
### What it does

Place the Flutter-fly on the floor or on a table. The central creased part should be slightly raised. Now blow at it along the surface on which it is kept. It flutters and moves.



### When it doesn't

First make sure the fold is alright. If you blow at the top of the Flutter-fly, it may not flutter. Keep blowing from different angles until you get it right.



## The Race of the Pig and the Beetle

### The cast of characters

◆ Pig	◆ Beetle
◆ Elephant	◆ Butterfly

Once upon a time, long after the time when the tortoise and the hare had their famous race, there was a pig. He heard the story of the famous race, and he decided that he wanted to have a race too. "I'll challenge someone to a race," he thought. "But whom?"

First he went to the elephant. "Will you race with me?" he asked. But the elephant was too busy learning to play the trumpet. So he asked a butterfly. But the butterfly was writing her autobiography. It was called 'Caterpillar of Society'. Then he found a beetle, and asked her to race. The beetle agreed. So they had a race, but who won?

Find out for yourself: make a beetle and a pig and blow at them, to see who reaches first.



## The Bernoulli Principle

This toy works on the Bernoulli principle which states that the pressure in a moving liquid or gas varies inversely as the speed of the liquid or gas.

To understand this, observe the action of an aerofoil. The air passes over and under the aerofoil (Fig. 1). Because the upper surface is curved, the velocity of air on top is higher than the velocity of air below. Applying the Bernoulli principle, it follows that the pressure above is lower than the pressure below. The difference in pressure causes a resultant upward force, or lift. The pressure is not uniform over the surface. The point at which the lift acts ( $L$ ) is called the centre of lift (Fig. 2). For an object to be balanced, the centre of lift and centre of gravity must lie on the same line.

But does all this explain why the Flutter-fly flutters? Only partly. When you blow at the Flutter-fly, the resultant lift makes it rise (Fig. 3), but the lift is not enough to counter its weight, so it comes down again. The Flutter-fly has a crease along the diagonal, so the toy is balanced at two corners. When you blow at it, the lift causes it to tilt. As you keep blowing, the wind pushes the far side up again. This process is repeated continuously, so the Flutter-fly tilts backwards and forwards rapidly.

### Try

Make a Flutter-fly in the shape of an arrow-head. Now blow at the tip. It flutters. When you blow from the other side, it almost takes off. The lift is obviously greater. So the amount of lift depends on the shape in relation to the direction of the air flow.

### Think

The Bernoulli principle is applied in the manufacture of aeroplanes. It is possible to design aircraft wings in a way that maximises the lift.

When an aeroplane moves forward, the air flows over and under the wings. Because of the aerodynamic design of the wing, the velocity of the air passing over the wing is much higher than that of the air passing below. When the resultant lift becomes high enough to counter the gravitational force acting on the aeroplane, it takes off.

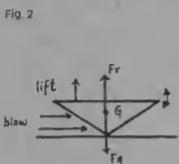
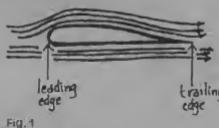


Fig. 3



## Play Value

The Flutter-fly was one of the simplest toys we made, but the imaginative possibilities it opened up were surprising. It had very high play value.

We thought about how to judge toys we buy for children, on the basis of their play value. With the growth of a new affluent middle class in India, there are large numbers of wealthy and unthinking parents, who think the latest thing in the market and all that money can buy is best for their child.

We need to be wary of succumbing mindlessly to every novelty the toy industry puts out and exhorts the child to possess. Some of these have very doubtful value. They are status objects for their owners, fostering ego and greed rather than play. Expensive battery operated racing cars, cell phones or imitation fax machines are some examples.

The marketing of many of these products is generally aggressive, and exploits children's emotions. Children cannot be expected to resist such an onslaught on their own. They need adult support and guidance when they decide to buy toys for themselves or their friends.

We thought up a broad list of guidelines:

1. Expensive toys need not necessarily be the best in terms of play value.
2. A toy which is part of a very specific context, needing many ready-made accessories, is short-lived and geared towards consumerism. Does the toy also bring in values you do not wish to endorse (status, money)?

3. Examine educational toys carefully—does your child really need that kind of pressure?

4. What experiences does the toy offer in terms of creative participation or imaginative possibilities?

5. Is the toy stereotypically a 'boy' or 'girl' toy? Do you wish to endorse this kind of strict division?

6. Does it foster violence?

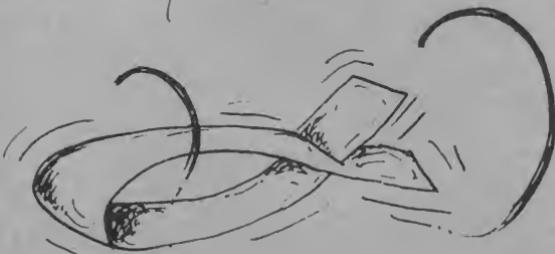


No accessories required



## SPINNING SARDINE

Watch the sardines  
Flying and spinning  
The last one to land  
Is the one that's winning.



### Spinning Sardine

#### What it is made of

- ◆ A piece of paper, 12 x 1.5 cm

#### How it is made

1. Make two slits on the piece of paper, as shown.



2. Fold the paper at the centre and lock the slits into each other.



#### What it does

Throw the Sardine into the air. It flies down, spinning round and round.



#### When it doesn't

If the strip is too broad, it may not spin well. Try making the strip narrower. Maybe the 'tail' of the sardine is too short or too long.

#### Last is First

Have a Sardine Race. Climb onto chairs, tables or window sills. Each contestant should throw her Sardine as high as possible.

The last Sardine to land is not the loser, but the winner.

(Warning: make sure the tables and chairs are sturdy and that the windows have bars.)

## Turning Force: Horizontal Axis

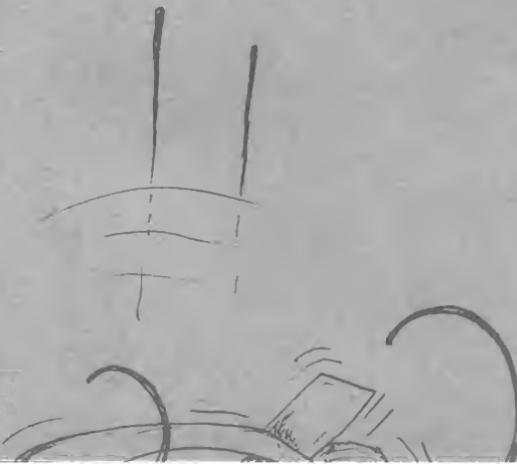
This toy works in the same way as the Retrocile. The difference is that since the most stable position of the Sardine is horizontal, it spins horizontally rather than vertically. The two blades that form the tail of the Sardine are bent at opposite angles with respect to the horizontal axis.

### Try

Make a broad Sardine and a narrow one, and launch them together from the same height. Which one spins better? Which one lands first?

### Think

Suppose the tail-blades of the Sardine are not bent. What will happen then? Do you think it will rotate?



Also welcome in this playground. Children above 18

We watched a group of children play with their Spinning Sardines, and reflected that less children play together on the streets these days, at least in the middle and upper class suburbs.

Many children have no time for this kind of free play. Others have no place, in crowded apartment blocks. Even when a group of children get together, they need toys and games to play with, rather than simply with each other. The nature of play has changed.

Traditionally, in many cultures, toys were props for play, rather than the other way around. Play came first, toys followed. Toys were made at home, out of clay or rags which stood in for dolls, or anything else the child fancied. Many toys were made by children themselves, to meet their own ideas of play.

In traditional play, children were involved in joint activities—allocating roles, trying out ideas, disagreeing, resolving differences. They also learnt to share, take turns, cooperate and develop scripts and stories.

Play was also among mixed age groups. In India, children and adults often played the same games, like they performed the same tasks towards making a living.

The concept of childhood as something entirely separated from adulthood is a notion which arose in nineteenth century Europe.

With the coming of the culture of the market, this has translated into the development of products exclusively for children. Play today has become more centred on commodities, and less around free interaction and participation.

In India, traditional play is still around. But only poorer children still play freely, spinning hand-made windmills and chasing old cycle tyres. This may well be because they have no choice in the matter, since they lack money to buy toys.

For wealthier children, the market culture of consumption is taking over play more and more. Ironically, we consider these children enriched, rather than impoverished.



## NAF

Run with a Naf?

Race with a Naf?

Or keep it up longest

And have the last laf?



# 12

## Naf

### What it is made of

- ◆ 3 strips of paper, 25 x 2.5 cm each

### How it is made

1. Take the three strips of paper, and fold each of them in half.



2. Interlock them exactly as shown. The open end of each strip is held between the folds of another strip. Pull the ends gently, one by one, till they form a conical shape in the centre.



### What it does

Place one end of a blunt pencil at the centre of the Naf and run with it. It spins round and round. If you drop it from a height, it will spin down.



### When it doesn't

Run faster. Or use a different kind of paper.

### Naf-a-thon

Race to the finishing line without dropping the Naf. If you lost, so what? He who reaches last Nafs longest.

## Rotation Due to Air Flow

Can you guess why we called this toy a Naf?

Hint: remember Retpocieh?

A fan moves using electricity, and the movement causes air to flow. In our toy, though, the air flow causes the movement. The faster you run, the faster the air flow, and the greater the movement. It works in the same way as the Retpocieh. The difference is only in the direction of the air flow. The blades of the Naf are also bent in one direction, and this is why it rotates.

### Try

Make a Naf with different kinds of paper.

Colour the blades, and see what happens when it spins.

### Think

Look carefully at the blades of a ceiling fan, and try to guess which way they must rotate for air to be pushed downwards.

Now switch it on, and check if you were right.



## For Boys and Girls

We were happy to see both boys and girls in our group running around with their Nafs. Usually, boys run around actively, while girls tend to sit and talk. We accept this as natural. Even though we encounter many living examples to the contrary, such stereotypes persist.

We decided to look at it the other way around: that adults actually use gender stereotypes to socialise boys and girls into what society expects them to be.

Toys, and different kinds of play, are an important part of socialisation. For instance in Europe, around a century and a half ago, baby dolls used to be for both sexes. During the late nineteenth century play with dolls became exclusively a girl's domain.

Now it is not just society but also the toy industry which determines what boys and girls play with. The industry mirrors social conventions: its ideas on gender are largely unquestioned. Kitchen sets are meant for girls, and toy soldiers for boys. This has taken on even more extreme forms, with many toys today extolling male violence and female sex appeal.

Most toys for boys are macho and action oriented. This has a neat reverse side for girls, whose whole domain of existence centres around looks. The baby doll has been overshadowed by a sexy young woman, of which Barbie is the best example. She does nothing apart from dress up, shop, go out and look good.

It is unsurprising that this form of socialisation is a self-fulfilling prophecy: boys with guns

will turn out to be aggressive, and girls playing Barbie stay pretty and docile. The solution obviously does not lie merely in exchanging playthings. It is the very basis of these toys, linked to their gendered nature, which is objectionable.

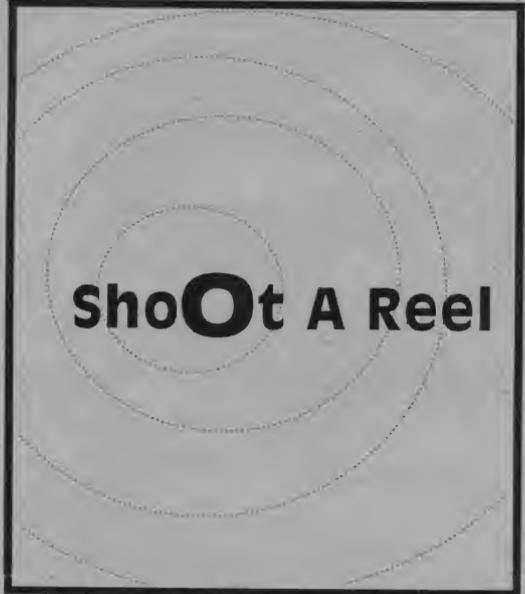
We need new kinds of toys, for instance those which allow mobility and adventure for girls. Where are the female equivalents of cars? Or dolls which let boys fantasise about relationships? What about boys and girls playing together?

All children, regardless of sex, need to experience various kinds of play: physical, imaginative, quiet, exuberant, solitary and social. To divide these needs into innate boy and girl oppositions is to deny an individual child the freedom and right to a range of play.



Gents

Ladies



**ShoOt A Reel**

Toys that Need Skill

**Huff-n-puff****What it is made of**

- ◆ An empty thread reel
- ◆ Paper
- ◆ A light bead
- ◆ Glue

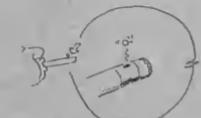
**How it is made**

1. Make a small hole in one side of the reel.



2. Seal off one end of the reel by pasting paper on it.

3. Place the bead on the hole.

**What it does**

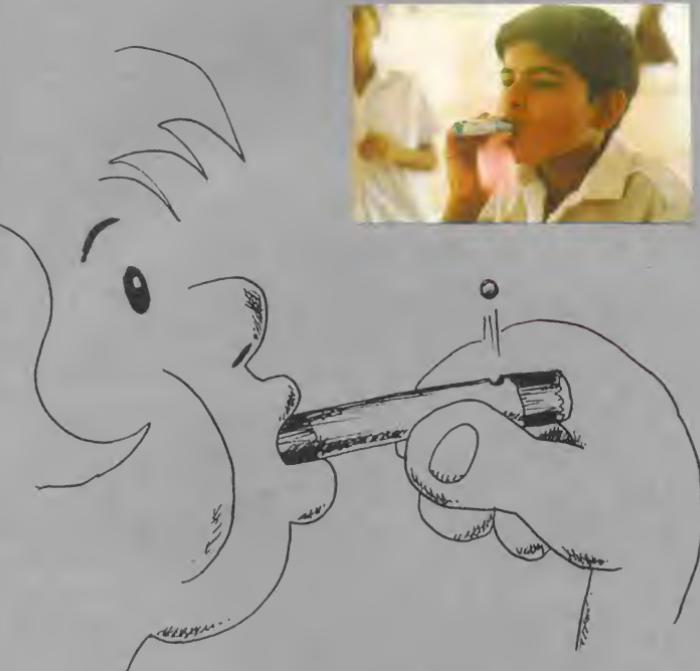
Blow hard and steadily through the open end of the tube. The bead stays up in the air, spinning.

**When it doesn't**

If the bead is too heavy or not spherical, it will be difficult to lift and keep it in the air. But if it is a light, round plastic bead, all you need to do is huff and puff till you blow the bead up. Keep trying till you get it.

**Who is the Huffiest of Them All?**

Who can keep the bead up the longest? The highest?

**HUFF-N-PUFF**

Huff and puff

The bead goes uff.

## Air Pressure and Smooth Air Flow

The air that you blow is channelled through the hole, and exerts a pressure upwards on the bead. This force counters the gravitational force and keeps the bead up. The smooth (laminar) air flow around the bead keeps it above the hole.

### Try

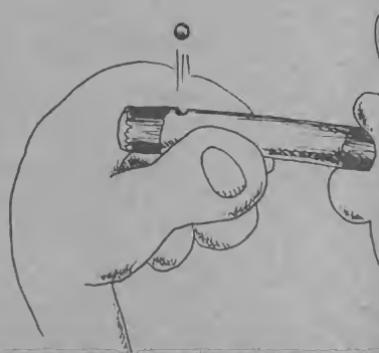
Do it with your eyes closed and see what happens.

What happens if you blow too hard?

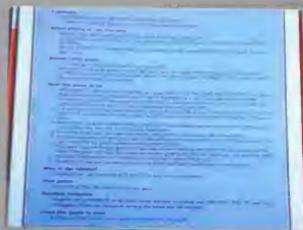
### Think

If you use a heavy ball instead of a light one, can you keep it up in the air? Why not?

Hint: you might be able to do it if you have unusually powerful lungs.



## Changing the Rules of the Game



Let's get on with the game

The children devised games with their Huff-a-puffs, some simple and some fairly elaborate. Rules kept changing constantly. There was a lot of bickering, negotiation and compromise.

When play is turned into a game, a set of rules needs to be defined, and all the players have to adhere to them. It is important for children to participate in this kind of decision-making, in changing the rules of the game.

Do the kind of games children play these days encourage a sense of democratic participation? Who frames the rules and what are they?

We found that some simple outdoor games—like hide and seek, or marbles—allow a flexible and creative framing of new rules.

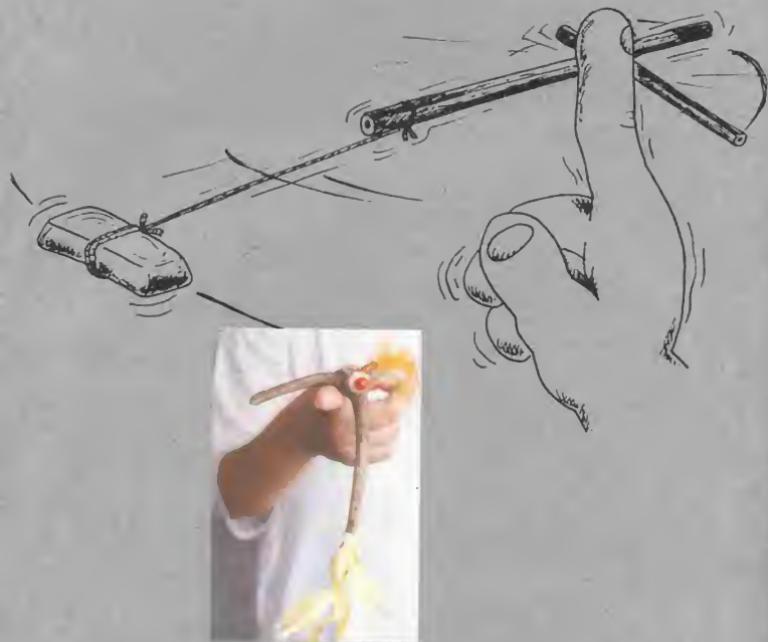
Of the indoor games available in the market, most had strict rules. The children said that they preferred games with simpler rules—the more complicated they got, the harder it became to play together.

The most problematic for us were the large numbers of games set in specific contexts. The rules of these games are literally the basis on which contemporary society is run: money, exploitation, and unquestioning social values.

We found a doctor set which only let the child operate on one particular organ. The winner of the game was the one who managed to charge the most fees for an operation.

We also looked at complex board games based on adult situations like career, marriage, babies or car insurance. The manner in which the play options were presented did not allow the child the creative freedom to question any of the givens. For instance, she needs to pay up for a 'son's education' or a 'daughter's marriage'.

We asked ourselves: who makes these rules? And are they the ones we finally expect our children to adhere to?



## PENCYCLE

Keep it going! Don't let it stop!  
Keep it spinning! Don't let it drop!

### Pencycle

#### What it is made of

- ◆ A short pencil
- ◆ A long pencil
- ◆ A piece of strong string, 15 cm
- ◆ An eraser

#### How it is made

1. Tie the two pencils together, at right angles to each other.



2. Tie the eraser at one end of the piece of string.



3. Make a groove near the base of the long pencil.



4. Tie the free end of the string along the groove.



#### What it does

Place your finger at the angle between the two pencils and twirl the Pencycle around.



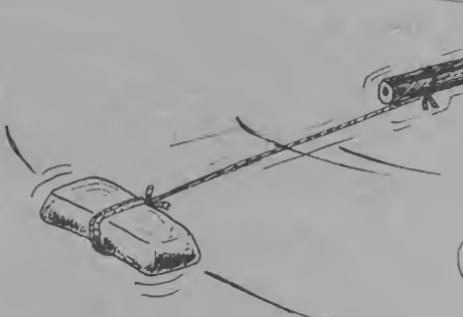
## When it doesn't

This is like learning to ride a bicycle. At first it looks impossible, then suddenly you get the perfect balance, and you can never unlearn it.

13 ⇔ 16

## Pencycle Games

- ◆ The Great Pencycle Race
- ◆ The Pencycle which Rotates the Longest
- ◆ The Rotating Pencycle Transfer from One Hand to the Other



## Centrifugal and Centripetal Forces

When the Pencycle rotates, there is a centrifugal force, which pulls the eraser away from your finger, and a centripetal force which pulls it towards your finger. Your finger acts as a pivot. You have to shift its position constantly in order to maintain the tension in the string.

### Try

Instead of using two pencils, see if you can find an L-shaped twig.

Try making the toy with different lengths of the string. Why is it difficult to rotate the Pencycle if the string is too long?

Hint: centrifugal force =  $(\text{mass} \times \text{square of velocity})/\text{radius of rotation}$ . The longer the string, the greater the radius of rotation.

Instead of the eraser, use a flower. Does it work? Try attaching two flowers, then three, then four ... until you reach a point when the toy does not work.

### Think

Can you guess why the Pencycle falls off if you slow down the rotation?

Why do you need a certain amount of skill to play with the Pencycle? You have to make sure that at every moment your finger is in contact with both the pencils. Since one side of the angle is open, it requires some dexterity to do this.

Why is it that if the object at the end of the string is too heavy, the Pencycle flies off the finger?



## Toys Without Form



kite, pet, balloon, cap, jelly-fish, water-squirters

Throughout history, children have played, and it has not been as a result of having toys. They have played with sticks, pebbles, ropes or cycle wheels—things picked up and turned into toys.

The Penycycle belongs to this category. We decided to call these objects 'toys without form', since they can stand in for anything, depending on the play situation. Sadly, this kind of free play is disappearing, particularly for affluent children.

A majority of the popular toys today foster another kind of play, in which each toy represents an actual object. They can be dolls, cars, space ships, teddy bears, or fantasy figures like He-Man or Barbie.

Toys which represent actual objects have a place in children's play. They allow children to experiment with actions, relationships and

feelings which mirror the real, or the longed for, in a particular culture. A favourite teddy bear or doll is a friend. A car or train set can take the child off on any number of imaginary adventures.

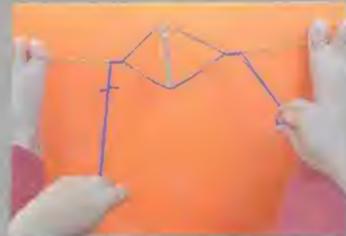
But there is a problem with the increasing number of toys in the market which come with complete plots and innumerable accessories attached to them. The more narrowly defined the toy, the more it limits play and the child's imagination into fixed patterns.

A related danger arises from the fact that these toys and the stories around them are created by professionals in the toy industry, whose world view is defined mainly by the needs of the market. When a child plays exclusively with these objects, she is indoctrinated very early into buying into the dreams and values of those who control the market.

So children need to play with an equal number of objects which are not so specific, they need more toys without form. These contain the potential for unlimited individual interpretation, since no one but the child decides what it is to be or become. Play comes first, toys follow.

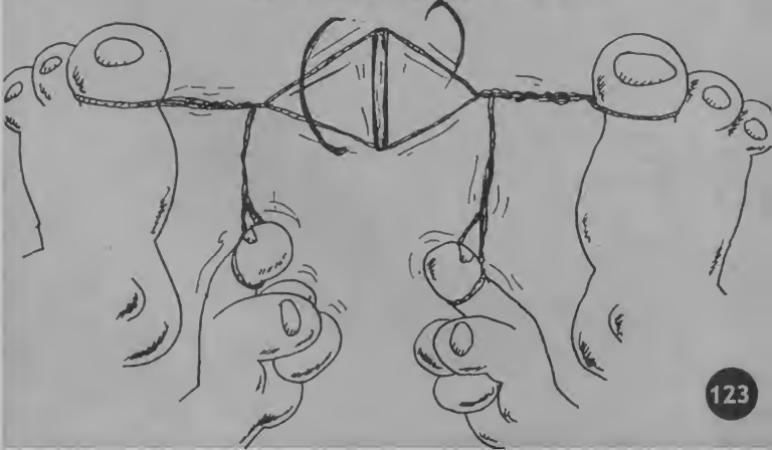
Unfortunately, many children (and adults) today believe that toys without form are inferior, only meant for children who can't afford anything better. This only demonstrates the insidiousness of market forces.

Buying into its values induces children and adults into believing that packaged toys are always better and more desirable than playing around with sticks and stones.



## COMA-TOES

Round and round and round and round  
And round and round around your toes  
Round and round and round and round  
And round and round and round it goes  
Round and round and round and round  
And ... no wonder it's Coma-toes.



# 12

## Coma-toes

### What it is made of

- ◆ An ice-cream stick
- ◆ 2 pieces of string, 80 cm each
- ◆ 2 feet, preferably your own

### How it is made

1. Make two notches on either end of the ice-cream stick.



2. Make two loops with the string.



3. Sit down and stretch your legs out. Hook the two ends of one of the loops over your two big toes as shown. Stretch it tight. Now wedge the stick between the two sides of the loop.



4. Turn the stick round and round, winding the string.



5. Hold the stick in this position. Don't let go, or the string will unwind. Pass the two sides of the second loop through the wedges of the stick.

6. Hold the second loop along with the first loop taking care not to let the stick spin.



7. Now gently release your hold, letting the stick spin a little bit at a time. As the first string slowly unwinds, the second string winds itself around the first one.



8. When there are about 4 to 5 cm of string left on either side, hold the ends of the second loop.



### What it does

Hold the two free ends of the second loop and pull it gently, a short way. The stick rotates swiftly. Then release the pressure slowly, and it will rotate in the other direction. With a bit of practice you will be able to do this swiftly.



### When it doesn't

Pull and release the string gently. This might need a bit of patience and practice. If you pull it with a jerk the string will come off.

### Round and Round

There's only one thing to do with a Coma-toes.

Sit down in a comfortable place, pull the strings and spin it round and round and round and round and round and round ...

If you can come up with other interesting ways to play with this toy, we'll change its name.



## Conservation of Energy

The principle behind this toy is the law of conservation of energy. According to this law, energy can neither be created nor destroyed. It can only be converted from one form to another.

Energy is transferred from one string to the other, and from the strings to the stick. When you twist the first string the work you do is converted to elastic deformation energy and stored in the twisted string.

When you slowly release the string, and let the second string twist around it, part of the energy from the first string is transferred to the second string and stored there.

The whole toy now acts as a system that transfers energy from one part to another. So when you pull the loops, the energy you put in is transferred from one string to the other. Finally, it is converted to kinetic energy in the stick, causing it to rotate.

### Try

Use rubber bands in place of strings. Does the toy still work?

### Think

Have you ever seen an old manual lathe machine or a manual carpenter's drill which is driven by a bowstring? This toy works the same way.

## What is Play?

We wondered what the children found interesting in this toy. As far as we could see, it seemed fairly pointless to play with a stick and a string twisted around your toes. In fact it was as close to an alpha-state as it is possible to get without the help of television.

But the children played enthusiastically with their *Coma-toes*. Its very pointlessness appealed to them most.

This brought us to the heart of play—its lack of any goal, apart from itself. Much of it appears pointless and maddeningly repetitive to the average adult. Sadly, the majority of them have lost the ability to play, when there are no stakes involved.

Understanding the nature of play is not easy. It is difficult to define, though easy to recognise. Play can be joyful, flexible, inventive, imaginative, solitary, communicative, social, repetitive, random, quiet or exuberant. It can be physical, with toys, with friends, or alone, with neither toys nor friends.

Play is almost always creative, since it shuts off from ordinary directions, from the everyday world. It stretches the boundaries of thought, taking us beyond reality-bound rules, which tell us what to do, how to think and how to act.

Although elements of structure can be present, play is always shaped and directed by a very unique, personal quality.

Play is important for today's child for two reasons. For one, it gives a sense of control and individuality in a culture which pressures children into homogeneity.

Secondly, its lack of a goal restores true creativity to children in an age where almost everything is directed towards an ambitious, competitive goal.

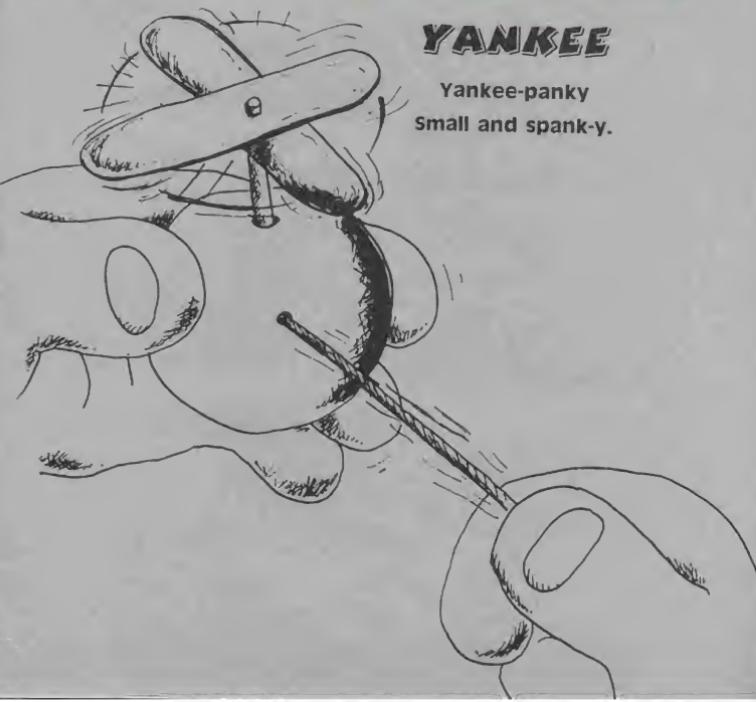


Blowing a spit bubble



## YANKEE

Yankee-panky  
small and spank-y.



## Yankee

### What it is made of

- ◆ An old table-tennis ball
- ◆ Strong string, 30 cm
- ◆ A stick, 7 cm long, 0.5 cm thick
- ◆ Cardboard or ice-cream sticks

### How it is made

1. Tie a piece of string around the centre of the stick.



2. Cut out two small strips of cardboard and make a hole at the centre of each of them. You could also use two ice-cream sticks instead.



3. Fix the two pieces cross-wise, onto the other end of the stick.



4. Make a hole in the table-tennis ball. An easy way to do this: light a matchstick, blow it out and at once push the burnt end into the ball. The ball is made of plastic, so it melts at that point.



5. Push the lower part of the stick into the hole.



6. Make another hole, at right angles to the first one.



7. Pull out the string through this hole using a pin or wire.



### What it does

Rotate the cardboard fan round and round until the string is completely wound around the stick. Leave a small bit of string hanging out of the hole. Pull the string with a jerk and release it. The fan on top spins round one way, and then immediately spins the other way, rewinding the string around the stick.

### When it doesn't

The trick is in the way you yank the string. You need to pull it with a jerk, but when the string is fully unwound, you have to release it slowly, so that it can rewind itself around the stick. Keep trying. After a while you will be able to spin it continuously.



### The Mystery of the Missing Pulp

This toy was originally made in Kerala, with a rubber seed. But how did people hollow it out without cracking it?

They made the two holes in the seed and left it out in the fields, near an anthill. After a while, they picked it up. It was hollow!

Whodunnit? Ants got into the seed, and ate up all the pulp in it.

13 ⇄ 16

## Rotational Momentum

The string is wound around the stick. When you pull the string, the elastic stretch of the string is converted to rotational energy of the stick, and the stick rotates. This makes the fan spin. When the string is slackened, the stick continues to rotate because of the rotational momentum and is only slowed down by friction. The string winds itself around the stick in the opposite direction, so when you yank the string again this process is repeated.

### Try

Instead of a fan, try fixing other things on top of the Yankee, like a doll or a flower made of some light material.

### Think

Why must you pull the string with a jerk?

The rotational energy created in the stick depends on the speed that it reaches. If the string is pulled gently, the energy is not enough to overcome the frictional forces acting in the opposite direction, and the stick might stop rotating before the string is fully wound around it.



## Documenting Tradition

This toy has a fascinating history. It was originally made in Kerala, using the shell of a rubber seed.

But the seed had to be hollowed out first, without cracking it. We discovered that children managed this by leaving the seed near an anthill. Ants entered the seed and ate up the pulp, hollowing the seed out without damaging it.

For children in Kerala, the idea for this toy arose as a result of a close observation of their environment. Toymakers were later inspired to modify it, so that it could be made with other materials.

We know very little about innovation and development in different parts of our own country. Tracing the development of a particular toy keeps alive a variety of inspiration from different sources.

This is needed in a country like India, where there is little indigenous design or development for the toy market, in spite of hundreds of folk toymakers, each with their own innovative designs.

Most toys in the market today are either licensed from other countries, or cheap imitations of toys made elsewhere.

A complete revival of old ways of toymaking may not be possible in today's context. But a first step towards bringing in a variety of inspiration in this area is through tracing and documenting tradition.



Already part of history



**CREEP-JEEP**

Climbers, creepers  
Losers? Jeepers!

# 12

## Creep-jeep

### What it is made of

- ◆ A discarded cigarette box
- ◆ A plastic straw
- ◆ An empty match box
- ◆ Cardboard, as needed
- ◆ A small stick, 10 cm
- ◆ Glue
- ◆ 2 pieces of string, 60 cm each

### How it is made

1. Glue the match box on the cigarette box. Make wheels out of the cardboard and glue them to the sides of the cigarette box.



2. Cut three notches on the stick.



3. Cut out two pieces of the straw, about 4 cm each, and glue them on the underside of the cigarette box, slightly tapering towards one end. The distance between the straws at the narrower end should not be less than the distance between the notches at the two ends of the stick.



4. Pass two strings through the straws and tie one end of each to the two side notches on the stick. Tie a small loop of string to the middle notch.



### What it does

Hang the stick over a nail, by the loop in the middle. Hold the two free ends of the strings and pull them one by one to make the Creep-jeep climb up the slope.



### When it doesn't

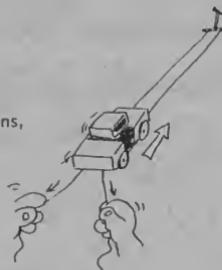
This is a matter of skill. Maybe the way the stick is fixed is not alright. If it is, then you need to learn how to pull the strings. Adopt King Bruce's motto (try and try until you succeed).

### Cable Car Race

This is a different kind of race. Whether you win or not depends on:

- how good your car looks,
- how smoothly and well it moves,
- whether it reaches first.

If your car satisfies the first two conditions, who cares about the third?



## Friction

At start, the left and right straws are at A and B respectively.

When you pull the right string, the left side of the stick moves upwards. By use of the angle of the straws, the friction causes the string to get jammed in the left straw at A. The right string moves downwards, so the right straw now moves up along the string to a new position C. Then when you pull the left string, the right straw gets jammed at C. The left straw moves downwards, so the left straw moves upwards to D. You get resultant movement upwards, along the string.

Turn the box around so that the straws are tapering downwards. You find that the Creep-Jeep creeps downhill. Observe it carefully and you will see that the same process is at work, but in reverse.

Now

What will happen if the straws are perfectly parallel and not tapering towards one end?

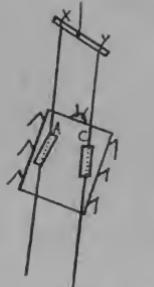


Fig. 2

Fig. 3

## Playing the Game

Play is purposeless activity, but in a game, the aim is to win. When we framed the rules for our cable car race, we tried using unusual criteria for winning.

Ideally, players should be judged on the basis of their pleasure in the game, heightened skill, aesthetics, fair play, and hard work.

Unfortunately, most games today are not played with these ends in view. The emphasis is more on strategy and robotic skill. The aim is to just to win, at all costs.

We spoke to some children who had just played a basketball tournament. They admitted that they enjoyed the game much more when they were playing among friends. The moment the stakes increased—honour of the school, prestige of the team, a cup to win or lose at the end of it—the nature of the game changed.

They could then no longer just enjoy playing the game to the best of their ability. At the mercy of abusive coaches and gruelling training, they played with a constant dread that they would let down their side.

Sadly enough, for a child growing up today, sports seem to be less and less about the simple enjoyment of physical play. For a majority of them, professional players are role models to be imitated.

Professionals have changed the way sports are played. The focus has shifted from the actual sport to equipment, big money and glamour. Advertising connects success at play to particular products: expensive shoes or professional equipment. The cult of winning is

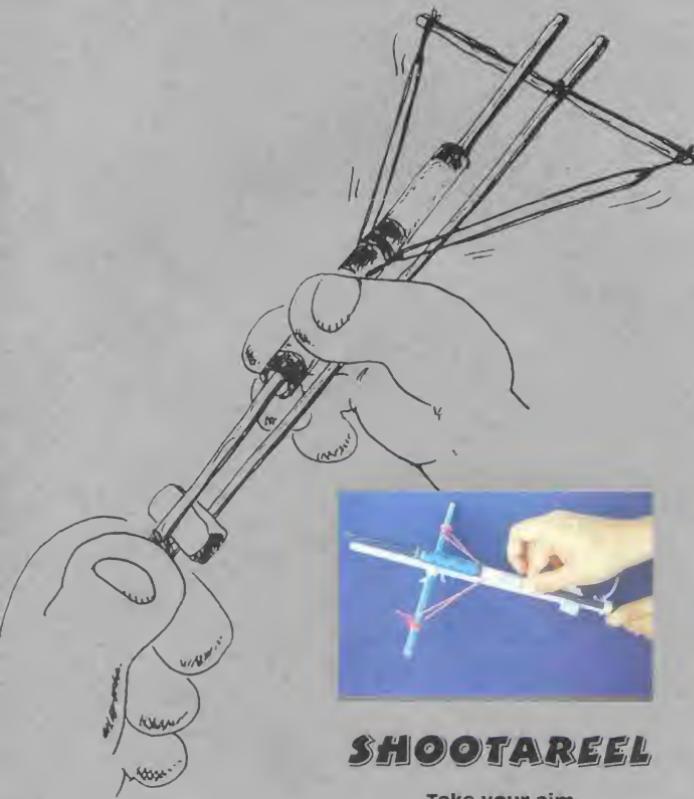
are controlled by the media, and twenty-four hour sports channels serve up endless contests.

The pressure to win at all costs leads to violence and ruthlessness, involving players and spectators alike. Players' bodies are pushed with drugs or electric shocks. Spectators fight each other. Winning or losing is even considered to be the honour of a nation.

Clearly, as the stakes increase, the play element in the game diminishes.



Let's thrash them



## SHOOTAREEL

Take your aim  
And Shootareel  
If you miss  
It's no big deal.

12

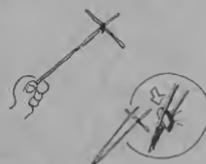
### Shootareel

#### What it is made of

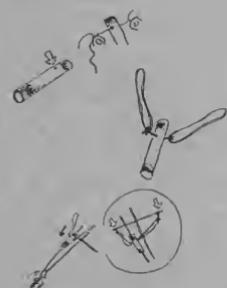
- ◆ 2 sticks, 30 cm each
- ◆ 2 long rubber bands
- ◆ 2 empty thread reels
- ◆ 1 stick, 15 cm
- ◆ String, as needed

#### How it is made

1. Tie the short stick to one of the long sticks, forming a cross.



2. Tie the other long stick to the cross, at the bottom. Wedge an eraser between the two, so that there is a gap of about 2 cm between them at the top.



3. Tie the two rubber bands to the thread reel. Tie the free ends of the rubber bands at the two ends of the cross-stick. Now slip the reel onto the other long stick.

4. Slip the second reel over the first one.



#### What it does

Pull down the lower reel, stretching the rubber band. Release it suddenly. The upper reel shoots out like an arrow.

#### When it doesn't

The rubber band might be too tight or too loose. The wedge might have fallen out. You may also need to practise a bit before you become an expert archer.



#### Fun and Games

How many games can you invent for this toy?

Here are a few:

Line up all your friends and see who can shoot the reel the farthest.

Line up all your friends again and see who can shoot it the highest.

Line up all your friends ... they'll probably be so fed up with lining up, that they'll go away. Then here is something you can play by yourself:

Keep a target and try to hit it. Give yourself a prize for every time that you miss. You get more prizes that way.

13 ⇄ 16

### Energy Conversion

When you pull the fixed reel, elastic energy is stored in the stretched rubber band. When you release it, this elastic energy gets converted to kinetic energy, and the reels move upwards. The free reel shoots out of the Shootareel.

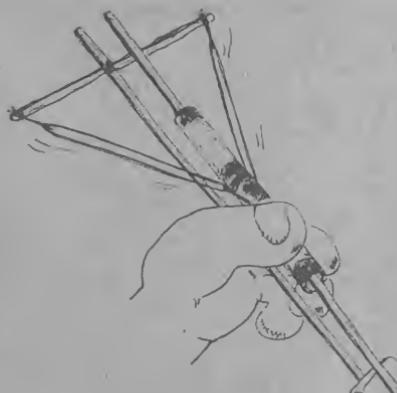
#### Try

You can make many kinds of shooting instruments, using this principle. Bow and arrow and catapult are two examples.

#### Think

What should you do to make your Shootareel shoot farther?

Hint. Increase the elastic energy.



## Violent Toys



### My hero

We observed the ways in which children were using the Shootareel—ranging from target practice and rocket imitations, to inevitably chasing and threatening each other. Had we helped them make a potentially violent toy?

Many people believe that playing with violent toys causes no lasting harm: it helps children fantasise and let off latent aggression. There is something to this argument.

Most of us have played 'Police and Robbers' as children, to no ostensible harm, and have matured into relatively peace-loving adults.

Still, today's culture of mindless aggression is different. Children are constantly bombarded with unbelievable gore through films, television, war toys and video games. Contemporary violence is pure style: 'cool' in the manner of action movie heroes or street gangs.

This barrage of violent messages glamourises brutality and desensitises the child. Playing with violent toys only extends this further, by channelling children's fantasies in even more violent ways.

We thought a little more about the Shootareel, and whether it belonged to the category of violent toys we did not wish to endorse. We observed that it was different from a toy weapon you can buy.

For one, it was only because of the way the Shootareel functioned that it could put to potentially violent uses. The form did not necessarily insist on being used violently. So the ways in which children played with it had more to do with their own fantasies. In fact, one child put wings on to the reel and launched birds into flight.

With a ready-made gun, the direction of play is already programmed. You shoot down people or animals with a gun. The fixed form of the toy translates into obvious use. This makes it harder for the child to do something completely different with the toy.

Moreover, while making a Shootareel, the child's creative energy is completely engaged in making the thing work. Along the way, how to use the toy becomes a much more open ended question.

The playing out of violent stories is less likely to engage the child who needs to pay careful attention to creating something.

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